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TELEPHONE ENGINEER

Volume XIX *CHICAGO, APRIL, 1918* *Number 4*

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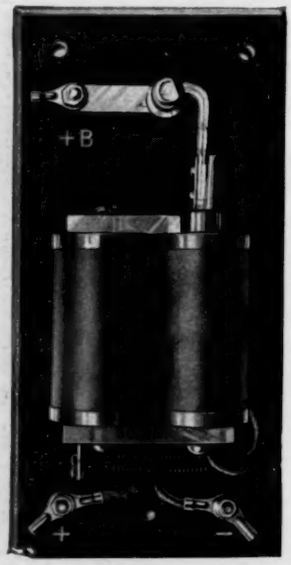

When the proper voltage for charging storage batteries is applied to its terminals, the circuit breaker

AUTOMATICALLY CLOSES

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Entered at Chicago Post Office as Second Class Mail Matter

Telephone Engineer

WITH WHICH IS CONSOLIDATED
The Western Telephone Journal
ESTABLISHED 1902

PUBLISHED MONTHLY BY
ELECTRICITY MAGAZINE CORPORATION
MONADNOCK BUILDING, CHICAGO, ILL.
Telephone: Harrison 3014—All Departments

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VOL. XIX CHICAGO, APRIL, 1918 NO. 4

Labor Turnover and the Alien Employee

THE utilities have undoubtedly suffered less than the producing industries by the excessive labor turnover resulting from war conditions. And of the utilities, the telephone companies have suffered less than the transportation companies. Nevertheless, the questions of labor changes, and particularly of the alien employee, are important to telephone operating because of the delicacy inherent to telephone plant and its essential function in national activity.

The employers of labor have already met and at least partly solved this problem. A large percentage of the Class A telephone companies have had unpleasant experiences with labor during our year of belligerency. Some of these experiences, under a guise of unionism, have enjoyed publicity at the hands of sincere but confused newspaper men. Other incidents, and accidents, have been recorded only upon the private memoranda of the companies' executives. And where there has been no activity that would classify as "trouble," the increased cost of the augmented labor turnover alone is a serious item.

An ideal system of checking the causes of local labor unrest and those alien activities which are due to ignorance and misunderstanding would involve undertaking a large amount of "missionary work" outside the recognized jurisdiction of the employer. It would involve the discouragement of local profiteers who exploit the employee, and efforts to win the alien by the tactful presentation of American truths. Much of this kind of work has been done. It may be less expensive to help the employee reduce his cost of living than to establish a new wage standard.

We would like to hear from some of our readers who are employers, and who doubtless have given the subject more attention than we have. Reports from telephone operating men who have met situations caused by the conditions would enable us to help those who so far have not satisfied themselves as to the solution.

* * *

More Business, Less Profit

THE annual reports of telephone companies for 1917, from the Bell booklet down to the typewritten sheets of small Independents, have one common peculiarity. It may be set down as a rule that 1917 showed a bigger gross business than 1916, and that almost without exception the net profits were smaller. In a number of cases, indeed, there were no net profits. Inasmuch as the condition was to be expected, under the circumstances, and the reasons are obvious, no analysis is necessary.

Notwithstanding the customary skepticism of the public, and the general belief that public service corporations always make large profits, the administration officially recognized the utilities need of assistance in a statement issued in February, upon which we commented in the March number.

Chicago's gas and electric utilities are sending out with every customer's bill a little slip with the administration statement printed on it. Other service corporations are using paid newspaper space to carry the same message.

Public suspicion of the financial good faith of the utilities arose out of the early policy

of silence and mystery of those same utilities. Frank publicity is the only cure for the lingering opposition, and the method the wise companies are using. Telephone companies whose executives dread the inevitable ordeal of rate-raising (and many of them do dread it) can prepare the way and make it easier by seeing that their subscribers receive authoritative facts and opinions.

* * *

Standardizing the Operator

SHORTLY before he entered the Service as a captain of the Signal Corps, Secretary W. S. Vivian of the U. S. I. T. A. conducted a quiz test of a group of long distance operators. While the average showing was very good it is worthy of comment that practically all of the errors and demerits were caused by departure from the exact wording of the regulations.

Perfect operating is practically a matter of exact phraseology. Once the proper phrase for a specific condition has been determined upon, efficiency calls for a literal and precise use of it. The important object of rule books, of traffic committees and of Co-operative schools for operators is, indeed, to provide an adequate catalog of such phrases and to insist upon their absolute adoptions. That is the only means of escape from the inefficiencies and confusions of unstandardized operating, as necessarily conducted by independent companies which neglect to confer with their connecting companies.

It would be unwise, perhaps, to convey to the operators at the board the impression that she was merely a piece of mechanism for articulating set phrases. Nevertheless, the more nearly that condition is approached, with all due tact and regard for the human element, the more nearly perfect will be the interchange of business between unrelated companies.

* * *

Discard That "Business as Usual" Idea

A TRADE paper editor laboring in another field claims that the little cards freely circulated some time ago, bearing the legend "Don't talk war—talk business!" were a part of organized German propaganda. Whether that is literally true or not, it might as well be; for it serves the German purpose admirably. If we don't talk war, and don't think war, we will not make war to any effective extent.

No man can possibly succeed in business with a policy of casual, occasional interest in it. War is the most jealous of all industries, and demands the most concentrated attention, not just on the part of "the government," but on the part of the nation. And the nation means US.

No institution, public or private, not even a public utility, can hope by ignoring it to escape the national obligation. The more of us put our attention and our means to work upon it, the lighter will be the burden and the sooner can we restore a condition where "business as usual" will be a creditable slogan.

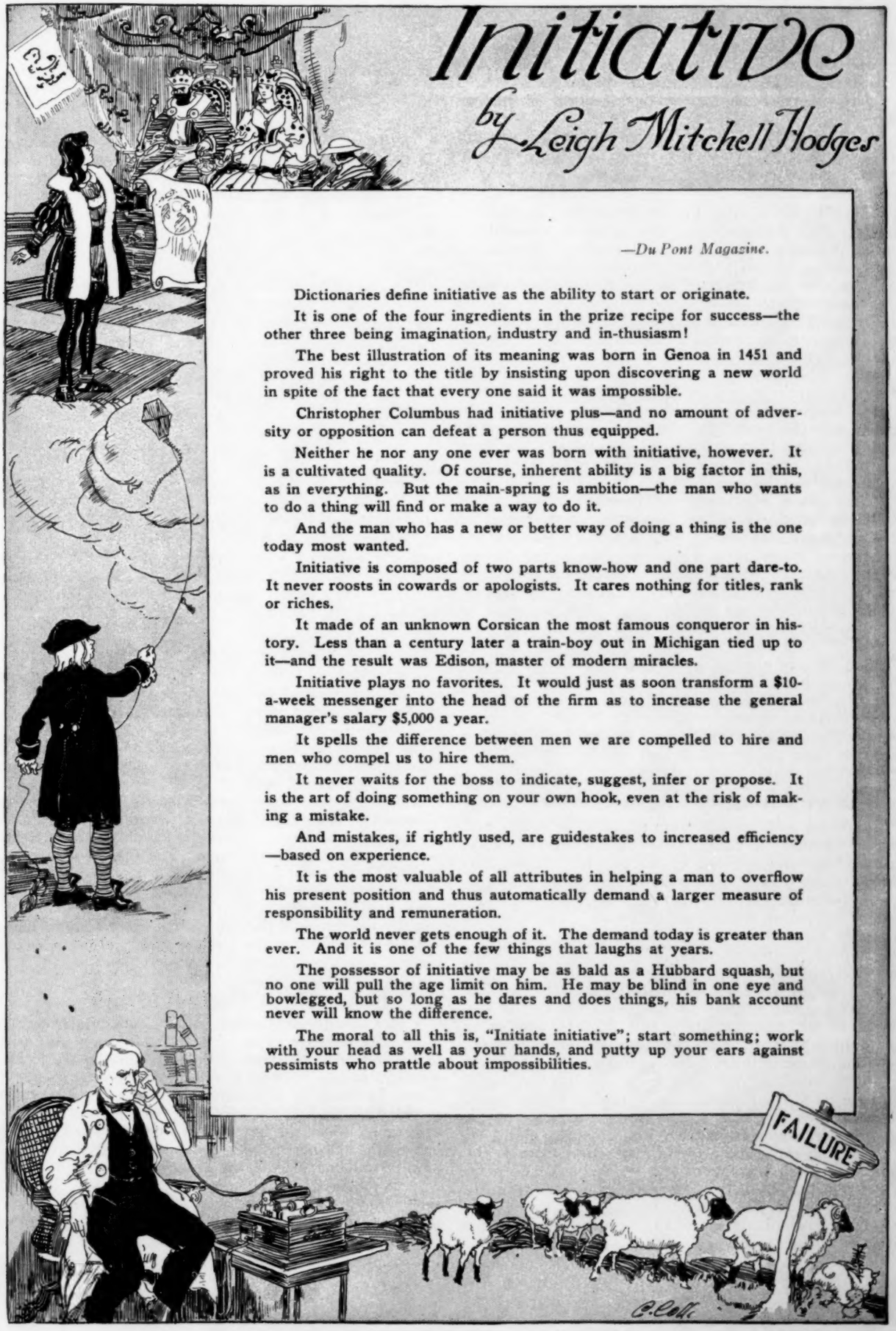
* * *

The Customary Logic of Government Ownership Arguments

AN editorial of more than usual asininity, even for a Hearst newspaper, appeared in the Chicago American March 4. It asks for government ownership of telephones because the Pullman Car Company refuses to make telephone reservations. The action of the Pullman company, of course, is in the interest of efficiency and a full car, and has nothing whatever to do with telephone service.

Not being constant readers of the Hearst columns, maybe we have missed some editorial urging government ownership of restaurants and hotels because they refuse to serve beef or pork or white bread on certain days.

If government control deprived telephone users of as many privileges as it has taken away from railroad customers, those who now cry for federalization would be the first to protest.



Initiative

by Leigh Mitchell Hodges

—*Du Pont Magazine.*

Dictionaries define initiative as the ability to start or originate.

It is one of the four ingredients in the prize recipe for success—the other three being imagination, industry and in-thusiasm!

The best illustration of its meaning was born in Genoa in 1451 and proved his right to the title by insisting upon discovering a new world in spite of the fact that every one said it was impossible.

Christopher Columbus had initiative plus—and no amount of adversity or opposition can defeat a person thus equipped.

Neither he nor any one ever was born with initiative, however. It is a cultivated quality. Of course, inherent ability is a big factor in this, as in everything. But the main-spring is ambition—the man who wants to do a thing will find or make a way to do it.

And the man who has a new or better way of doing a thing is the one today most wanted.

Initiative is composed of two parts know-how and one part dare-to. It never roosts in cowards or apologists. It cares nothing for titles, rank or riches.

It made of an unknown Corsican the most famous conqueror in history. Less than a century later a train-boy out in Michigan tied up to it—and the result was Edison, master of modern miracles.

Initiative plays no favorites. It would just as soon transform a $10-a-week messenger into the head of the firm as to increase the general manager's salary $5,000 a year.

It spells the difference between men we are compelled to hire and men who compel us to hire them.

It never waits for the boss to indicate, suggest, infer or propose. It is the art of doing something on your own hook, even at the risk of making a mistake.

And mistakes, if rightly used, are guidestakes to increased efficiency —based on experience.

It is the most valuable of all attributes in helping a man to overflow his present position and thus automatically demand a larger measure of responsibility and remuneration.

The world never gets enough of it. The demand today is greater than ever. And it is one of the few things that laughs at years.

The possessor of initiative may be as bald as a Hubbard squash, but no one will pull the age limit on him. He may be blind in one eye and bowlegged, but so long as he dares and does things, his bank account never will know the difference.

The moral to all this is, "Initiate initiative"; start something; work with your head as well as your hands, and putty up your ears against pessimists who prattle about impossibilities.

Iowa Men Discuss Problems

The Iowa Independent Telephone Association, in session March 19 at the Chamberlain hotel, Des Moines, Ia., opened with a banner attendance.

Two officers of the national association were present.

E. B. Fisher of Grand Rapids, Mich., chairman of the board of directors of the United States Independent Telephone Association, addressed the convention Wednesday afternoon. Mr. Fisher wore a service pin with two stars, representing his two sons.

President Robinson of the national association arrived Wednesday and extended greetings from Minnesota. He declared that his company, the Tri-State, would remain Independent despite new arrangements as to competition.

In speaking of the effect of the war on the telephone business, Secretary C. C. Deering of Des Moines said:

"The labor problem does not have for us quite so serious an aspect as it does for some lines of business. A large proportion of our employes have always been women, and the draft has resulted in a comparatively small increase. They are, however, gradually working into inside lines, such as switchboard repair work and similar inside employment."

The sessions continued on Thursday.

Representatives of the manufacturers came in early and were established with an entire floor of exhibit rooms, where their wares were displayed during the convention. Switchboards, telephones, telephone hardware, testing apparatus, manufacturers' specialties and all the incidentals of telephony were included in the veritable exposition that was held during the three days.

The officers elected were J. H. Denkhoff, Dyersville, president; J. M. Plaister, Fort Dodge, vice president; Charles C. Deering, Des Moines, secretary-treasurer; executive committee, J. O. Barnes, Marcus; George E. Atkinson, Creston; Earle D. Bellamy, Knoxville; and the president and vice president.

Five Hundred Texans Meet

Members and visitors from all parts of Texas and from a number of other states gathered in Dallas March 13 for the opening of the twelfth annual convention of the Texas Independent Telephone Association, an organization representing more than 700 Independent telephone companies in Texas. The meeting was much larger than the last annual gathering of the Independent telephone men, held in Dallas in February, 1917, at which some 350 were in attendance.

Officials of the association stated that the demand for space for the display of telephone apparatus and equipment by manufacturers and dealers was more than double that of last year. Approximately thirty telephone manufacturers were represented at the meeting. One manufacturer shipped to Dallas the large display used at the national convention of Independent telephone men in Chicago, this being the first time it has been sent away from that city.

The convention hall, in the junior ballroom of the Adolphus Hotel, was opened at 9 o'clock Wednesday for the registration of the delegates, this work being in the charge of E. M. Powell, manager of the Dallas Automatic Telephone Company. A meeting of the directors of the association was held at 9 o'clock. The convention was opened at 10 a. m. upon call to order by President R. B. Still of Tyler.

A patriotic address by R. E. L. Knight of Dallas, "Do Your Bit," was scheduled for the morning.

Appointment of committees for the convention concluded the work of the morning session. In the afternoon J. C. Kelsey of Chicago spoke on "Telephone Associations and Their Relations to Telephone Companies." The latter part of the afternoon session was devoted to matters of operating interest, under the supervision of A. J. Combs of Haskell.

During the afternoon a talk on "Pole Preservation" was to have been made by L. L. Hill of Minneapolis, Minn., president of the Page & Hill Pole Company, but he was detained in Washington.

A question box in charge of Messrs. John A. Stratton, C. Echols and William F. Qualls was a feature of the afternoon session, which adjourned at 5 o'clock.

An innovation of the meeting was the "Manufacturers and Dealers' Session," conducted by representatives and salesmen of the manufacturers of telephone supplies. The morning program was turned over to these men. This is a new feature, used for the first time at this convention.

An attendance of approximately 500 telephone men was registered at the meeting.

Officers elected were R. B. Still, Tyler, president; A. J. Combs, Haskell, and F. W. Gilber, Brownswood, vice presidents; E. C. Blomeyer, Waco, secretary; E. M. Powell, treasurer; L. S. Gardner, membership secretary. Directors, Stanberry Alderman, T. P. Stillwell, C. D. Longserre, J. Y. Rust, J. A. Stratton, E. G. Fehrenbach, J. A. Smith. Advisory board, J. B. Earle, S. A. Lindsey, C. A. Shock, J. C. Casler and G. N. Harrison.

Ohio Companies Merge

The Urbana (Ohio) Telephone Company, Independent, and the Central Union Urbana and branch lines will consolidate under one management. The new move means raising the business rate from $2.75 a month to $3.75 and the residence rates from $1.75 to $2.25. These rates are subject to a 25-cent reduction in each case upon prompt payment of bills.

The deal was consummated by W. C. Newton of the Central Union and C. H. Marvin, president of the Urbana company. The latter company is capitalized at $150,000, but only stock to the amount of $100,000 is outstanding. A $25,000 debt has hung over the company for the past nine years without ever being reduced, although the company paid dividends.

By the terms of the consolidation, the Central Union will invest $75,000 in the Urbana plant and become equal owners with the company.

Beam Buys Portage Company

H. L. Beatty of Ravenna, Miss Louise Butler of New York City, Horace Hine of Mantua, Frances Seiberling of Akron and Fred Smith of the latter city have sold their holdings in the Portage County Telephone Company to Frank L. Beam of Mt. Vernon, Ohio, a large telephone stockholder owning or controling a score of telephone companies in central and southern Ohio. The change of ownership will not mean any change in the management of the local exchanges in the county.

The company is at present operating its exchanges at Ravenna, Kent and Mantua and has a total of four thousand subscribers. Its investment in the county aggregates a quarter million dollars.

Transmission Efficiencies of Cord Circuits

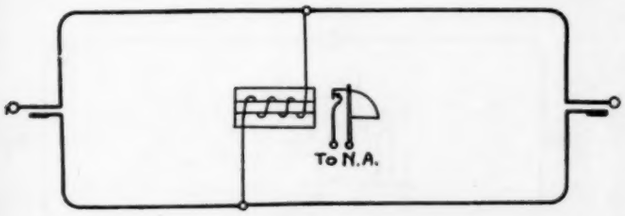
Presented at the Twelfth Annual Convention, Canadian Independent Telephone Association

BY WALTER C. FREEMAN *

DURING the past few years we have heard a great deal and read a great deal on the subject of "Transmission Efficiency" and the ways and means to improve the electrical properties of circuits so that the telephone using public may talk and hear telephonically over greater distances with the same ease that they conversed before the era of ultra-long distance toll lines.

This question of transmission efficiency is one that affects every telephone company, large and small, because it has a direct influence upon the earnings of the telephone operating company and upon its greatest asset—the good will and satisfaction of its subscribers. If, for example, one of your subscribers originates a toll call for Toronto, London or Buffalo and for some reason or other cannot hear distinctly and has difficulty in getting the message through to the distant station, the subscriber's confidence in your ability to deliver long-distance telephone satisfaction is diminished and such calls are made thereafter by that subscriber only when there is no alternative means of quick communication. On the other hand, if the long-distance conversation is carried on with the ease and clearness of local conversations the long-distance habit will grow and as a consequence the income from the resulting traffic will be proportionately higher.

In these days of swift progress the public demands improved telephone service, just as it demands speedy transportation from town to town and city to city. In this way we may draw a simile between the telephone company and the railroad company. In the case of the railroads increased speed and the use of heavier rolling stock made necessary the reballasting of roadbed, the elimination of steep grades, the straightening of tangents, and strengthening or rebuilding of bridges. In a like manner the telephone companies must provide increased transmission efficiency for both local and long-distance service by raising the standards of their line construction and maintenance, by the use of telephone instruments



Circuit A.

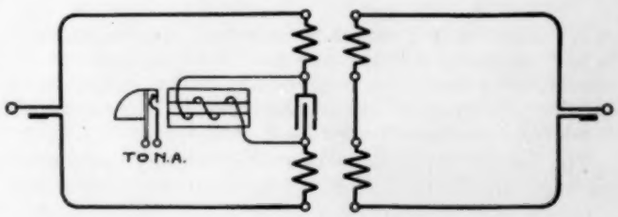
of tested and known high quality, and the elimination or abatement of transmission losses in their central office equipments.

The connecting cord circuits in local battery switchboards are common sources of transmission losses. The losses in the circuits are seldom taken into consideration by the smaller companies because of their confidence in the quality of the equipment furnished by the manufacturer. On the other hand, if losses in the switchboard are suspected they have no means of verifying their suspicions because of the lack of adequate testing equipment with which thef might determine the extent of the loss and localize the inefficient apparatus.

In this paper I shall discuss some of the types of cord circuits in common use and compare their relative transmission efficiencies and operating features. To begin with, let us review the characteristics which every local battery switchboard cord circuit ought to have. In my opinion the ideal cord circuit should

1st: Possess highest possible transmission efficiency.

2nd: It should be non-ring-through—in other words, the act of ringing-off by either one of two subscribers connected by means of the cord circuit should not ring the bells on the connected line.



Circuit B.

3rd: It should ring-off positively. The clearing-out drop or drops should operate every time, under any operating condition, when the subscriber signals for a disconnection.

4th: It should be equipped with two separate clearing-out drops arranged so as to give double supervision over local connections.

Reverting for a moment to the subject of transmission efficiency in general we should bear in mind that the addition of any series or bridged apparatus connected in the circuit introduces a transmission loss. In the case of apparatus connected in series the losses are large when the impedance is high and small when the impedance is low. In the case of bridged apparatus the condition is reversed, that is, when the bridged impedance is high the loss is small and when the impedance is low the loss is large.

There are other transmission factors which are to be considered when making transmission studies of circuits, but the two factors just mentioned are sufficient for our comparison of some typical cord circuits and give us a clearer understanding of the kinds to use and the kinds to be avoided.

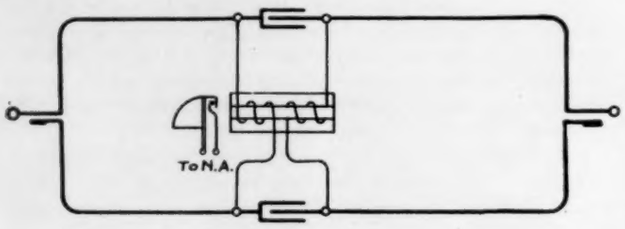
Circuit "A" shows the general arrangement of what most telephone men term a "single bridged drop cord circuit" and has, in the past, been used more than any other type because of its high transmission efficiency, low cost and extreme simplicity.

Tests made in our electrical laboratory under standard testing conditions show that this circuit has a transmission loss of approximately .25 of a mile of standard cable when a 500 ohm clearing-out drop is used and .15 of a mile of standard cable when a 1,000 ohm clearing-out drop is used. The greater loss in the case of the 500 ohm drop is due to the fact that its impedance is con-

*Advertising Manager, Stromberg-Carlson Telephone Manufacturing Company.

siderably less than that of the 1,000 ohm drop—this exemplifies the reduction of transmission efficiency in a circuit because of bridged apparatus.

This circuit has several serious operating disadvantages. In the first place it cannot be relied upon to give the operator a positive clearing-out signal under all operating conditions, particularly when a long rural line is connected to a short town line and the drop is shunted by the low resistance of the town line. In an attempt to lessen this trouble some companies use clearing-out



Circuit C.

drops which have a very low resistance, but this practice is not recommended because any resulting gain in the operation of the drop involves a sacrifice in the transmission efficiency of the cord circuit by reason of the lowdered impedance bridged across the circuit.

The second objection is that when one of two parties, on lines temporarily connected by a circuit of this type, rings off after completing a conversation, then the signal is apt to pass through the cord circuit besides operating the drop and cause false signals on the connected line.

The third objection is that since it has a single clearing-out drop the operator cannot tell whether one or both of the connected subscribers have signaled for the disconnection. To make sure that the conversation has been finished it is necessary for the operator to listen on the line and say "Operator" before taking down the connection. This, you will agree, is inefficient from an operating standpoint and especially troublesome during periods when the traffic is heavy.

In Circuit "B" we have a circuit which has been used to some extent by rural telephone companies, especially those operating systems composed of a mixture of grounded lines and metallic lines. This is a development of Circuit "A" and contains the additional equipment of a repeating coil and condenser. Some forms of this circuit are arranged with the repeating coil wired in the circuit permanently, while in others a key is provided whereby the operator may cut out the repeating coil when it is not needed—as for example when a connection is made between two quiet metallic circuits.

This circuit is furnished with a talk-through type repeating coil, that is, a repeating coil in which the windings and the iron in the magnetic circuit are designed to give the repeating coil greatest efficiency at voice current frequencies. The transmission loss in this type of circuit will range from .8 of a mile of standard cable, with a well designed repeating coil and drop, to 5 or 6 miles of cable with inefficient types of this apparatus. Some manufacturers have a practice of supplying this circuit without the condenser connected between the windings of the repeating coil on the clearing-out drop side of the cord circuit. Under this condition the circuit is inefficient in ringing-off. A test recently made in our laboratory throws some light on the relative ring-off values of the two circuits. We first wired the circuit with a 2 mf. condenser connected as shown in the diagram and connected an 80 ohm telephone ringer across the line connected to the clearing-out drop side of the cord circuit. Under this condition we were able to ring off from the opposite end through a resistance of 18,000 ohms; however, upon removing the condenser we were only able to ring-off through 2,500 ohms. This shows how important it is to insist upon having condensers wired in repeating coil cord circuits, as shown in the diagram "B" to obtain good "ring-off" qualities in circuits of this type.

This circuit is objectionable from an operating standpoint in that it is not provided with the two separate clearing-out drops necessary for double supervision.

This circuit is not absolutely non-ring-through, but is more free from ring-through troubles than the simple bridged drop circuit because the repeating coil will not transform the low-frequency ringing currents efficiently.

In Circuit "C," which fortunately is seldom used, you will note that there is a single clearing-out drop which is provided with two separate windings. The terminals of these windings lead to opposite halves of the cord circuit which are separate by condensers. The capacity of condensers used in this circuit is generally ½ microfarad in each side in order to divert the ring-off signaling current through the windings of the clearing-out drop.

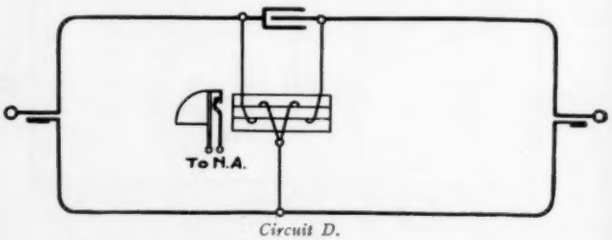
This circuit evidently was put on the market by some manufacturer who wanted an inexpensive sure ring-off circuit and didn't care much about its other qualities. Its transmission efficiency is poor—the loss ranges from 5 to 8 miles of standard cable, depending upon the impedance of the windings which must necessarily be kept quite low if the ring-off feature is to operate positively.

This is not a non-ring-through cord circuit because the common core and arrangement of the windings in the clearing-out drop coil makes the drop act as a transformer or ring-through type repeating coil.

Needless to say the use of such a circuit as this is not to be recommended if high transmission efficiency is desired.

The circuit shown by Diagram "D" is another single clearing-out drop type arranged to give improved ring-off service. It is somewhat similar to Circuit "C" in that a double wound clearing-out drop is employed, but only one condenser is employed.

As in Circuit "C" the object of the condenser is to oppose the flow of ring-off signaling current and to force



Circuit D.

it to traverse one or the other of the two windings of the coil and thereby operate the drop.

This circuit gives very good ring-off service but is objectionable in that its transmission efficiency is very low—the loss ranges from 4 to 6 miles of standard cable, depending upon the impedance of the drop. It is not proof against "ringing-through" because it possesses the disadvantage common to all double wound drops in cord circuits—transformer action from one winding to the other.

Another point which should not be overlooked is the

lack of symmetry or balance in the electrical properties of the circuit, due to the presence of a condenser in one side and not in the other. The unbalanced circuit condition is not particularly serious for local connections but is liable to be troublesome in exchanges where considerable long distance business is handled, especially when the long-distance lines are subject to induction from high tension power lines, as the induced current will naturally flow from one side of the circuit to the other and produce noise in the receivers while parties are using the line.

Circuit "E" provides for double supervision of connections by means of two separate clearing-out drops—one drop being connected to each of the two halves of the circuit formed by the condensers in each side of the circuit.

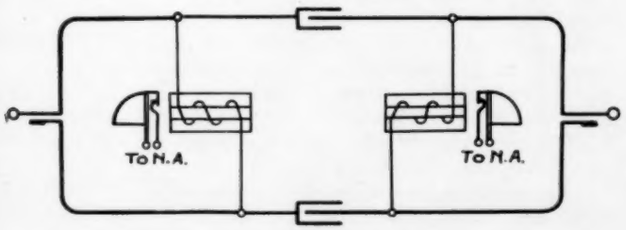
This circuit has the advantage that the clearing-out drop operates positively without the possibility of transformer action between the windings and consequent "ring-through" trouble. Its non-ring-through properties are also due to the use of the low capacity condensers in either side of the circuit which, being connected in series with each other, present an apparent high resistance to low frequency ringing currents. The arrangement of the circuit is symmetrical and the electrical properties are evenly balanced.

The advantages of this circuit, however, are outweighed by the relatively great transmission losses which are caused by the extra drop and the two series condensers. The loss in this circuit in miles of standard cable will range from 5 to 10 miles, depending upon the type of equipment used. To put the facts in a nutshell the operating advantages are gained only through considerable sacrifice of transmission efficiency.

The diagram of Circuit "F" shows the elements of a positive ring-off repeating coil type circuit which, to the best of my knowledge, has no been used very extensively.

It consists, as you will note, of a talk-through type repeating coil, two condensers each having a capacity of 2 mf. and a single clearing-out drop equipped with two separate windings, so that the drop may be operated by ring-off current from either end of the cord circuit.

The transmission losses in this circuit will range from 2 to 6 miles of standard cable, depending upon the



Circuit E.

individual efficiencies of the repeating coil and the clearing-out drop.

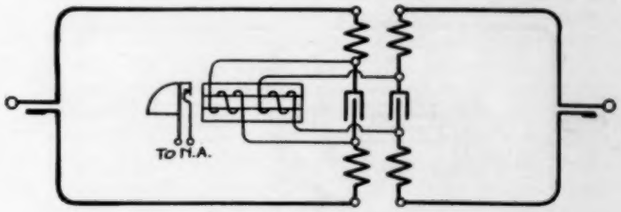
This circuit gives positive ring-offs, due to the use of talk-through type of repeating coil, but cannot be considered non-ring-through because of the double wound clearing-out drop which is liable to permit transformer action from one winding to the other and the transfer of signals when a short line is connected to a long line.

* * *

It is evident from our review of the different types of circuits shown that there is not one that satisfies all of our requirements. Unfortunately the circuit which has the highest transmission efficiency does not possess the necessary operating features and conversely the circuits which have the proper operating features have low transmission efficiencies.

The circuit which, in my opinion, completely satisfies our ideals of what a circuit should be, is the double clearing-out drop repeating coil cord Circuit "G."

It may seem like a rank heresy to some telephone men to propose a repeating coil cord circuit for all cord



Circuit F.

circuits in a switchboard; but we must remember that the repeating coil of today is a vastly more efficient piece of apparatus than the repeating coil of yesterday. In the past a repeating coil was a thing to be used only when absolutely necessary. Talk-through types of repeating coils are now obtainable in which the loss under average circuit conditions does not exceed 0.5 mile of standard cable under any operation condition, and often this loss is reduced to .35 mile of standard cable. This is a remarkable improvement over old types of coils in which a loss of 5 or 6 miles was to be expected when they were cut in the circuit.

When one of the new repeating coils and properly designed 500 ohm clearing-out drops are used, this circuit shows a transmission loss of only 1.15 mile of standard cable. When 1,000 ohm clearing-out drops are used this loss is reduced to about 1.09 miles of standard cable. This is loss is so small when the cord circuit is used for either local or long-distance connections that it is practically impossible for anyone but a trained tranmission expert to detect the difference between this circuit and the single bridged drop type of circuit which had the best talking qualities of any of the circuits which we have examined.

This circuit is non-ring-through because it is equipped with a special design of talk-through type of repeating coil.

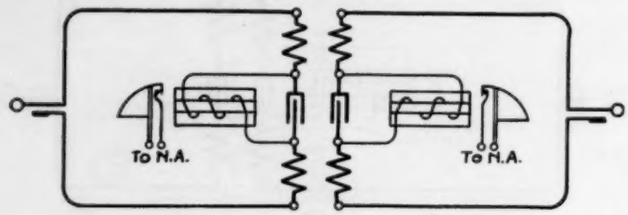
It rings-off positively, due to the efficient design of the repeating coil and the presence of the 2 mf. condensers connected between the inside terminals of the repeating coil windings.

It provides double supervision since it has two separate clearing-out drops.

You will observe that it satisfies every condition of the ideal cord circuit. The only objection that can possibly be raised against the circuit is its increased cost due to the addition of the repeating coil, condensers and the second clear-out drop. This increased cost should not be considered as an expense, but as an investment because the added equipment will give better service under all operating conditions. It is an investment that parallels the additional investment that railroad companies were obliged to make in order to provide adequate service by means of better rolling stock and better roadbeds.

Now, then, for the application of this circuit to long-distance traffic. In this connection a certain number

of cord circuits are each equipped with a repeating coil key—usually the first two pairs of cords on the left side of the operator's position. The repeating coil key in each circuit is wired so that the coil is normally in. When the key is normal the talking circuit and clearing-out drops are arranged exactly like the other cords in the switchboard. When the key is operated, however, the repeating coil is not cut out of the circuit in the customary way. Operation of the key gives so-called "zero loss" condition for long-distance service by cutting out only one side of the repeating coil with its associated clear-

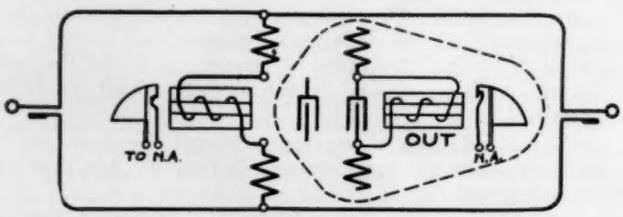


Circuit G-1.

ing-out drop and connecting the other in series with the minding of the other clearing-out drop. This gives the condition shown in the diagram "G-2."

Here we have a splendid circuit condition in which the impedance remaining bridged across the cord is that of the clearing-out drop plus that of one-half of the repeating coil. Under standard testing conditions this gives a loss in the cord circuit of only .08 mile of standard cable, or in other words, it is twice as good as the simple bridged clearing-out drop circuit. The loss closely approximates that of switchboard cord with a plug at each end so that it is well-termed a "zero loss" circuit.

The combination of these two cord circuits in a switchboard is very good from an operating standpoint because the operator may use all cords in the board for local connections, if needed, during busy hours. I firmly believe that this is the proper type of circuit to use and



Circuit G-2.

venture to predict that, regardless of its increased cost, it will be the circuit used most generally by telephone companies that consider transmission efficiency when making improvements in their central office equipments.

Siam Telephones Profitable

Bangkok, the capital city of Siam, is the only place in the kingdom which is equipped with a telephone system. The service is owned and operated by the government. In the fiscal year ended March 31, 1917, much progress was made in the use of the device. The average number of connections for twenty-four hours reached 12,755, compared with 9,320 for the corresponding period of last year. With the total receipts for the period covered fixed at $63,538, the profits amounted to $5,093. Vice-Consul Hansen's description shows that there are 821 telephones in Siam, including five public pay stations.

The High Cost of Maintenance

In a plea for higher rates, President J. W. Ozment, of the Palestine, Tex., Telephone Company, submits the following significant list of prices, past and present, for essential materials:

Galvanized strand, $9.65 per 1,000 feet, now $45 per 1,000 feet.

No. 19 twisted pair, $8.75 per 1,000 feet, now $13 to $18 per 1,000 feet.

Pot head wire, $13 per 1,000 feet, now $22.15 per 1,000 feet.

Switchboard cords and plugs, 85c, now $2.25.

Twelve-pin fir cross-arms, 43c, now $1.10.

One-half and 12 solder, 25c per pound, now 40 to 60c per pound.

Lead, 8c per pound, now 16c per pound.

Galvanized cross-arm braces, $36 per 1,000, now $152 per 1,000.

Two hundred pair copper cable, 53c per foot, now 75c per foot.

One hundred pair copper cable, 28c per foot, now 38c per foot.

Fifty pair copper cable, 18c per foot, now 22c per foot.

Twenty-five pair copper cable, 11½c per foot, now 19c per foot.

Dry batteries, 19c, now 33c.

Rent of office, $11 per month, now $98.50 per month.

No. 9 pony insulators, $22 per 1,000, now $31.28 per 1,000.

No. 14 black wire, 4½c per pound, now 8 65/100 per pound.

No. 14 E. B. B. galvanized, 5½c per pound, now 11½c per pound.

Switchboard lamps, 18c, now 32c.

Telephones, $10, now $15 each.

Cross-arm pins, $9 per 1,000, now $14.50 per 1,000.

Cedar 5-inch top, 25-foot poles, 85c each, now $2.60.

Cedar 6-inch top, 30-foot poles, $2.60 each, now $6.45.

Cedar 6-inch top, 35-foot poles, $7.70 each, now $9.

Cedar 7-inch top, 45-foot poles, $8.50 each, now $21.05.

Washington's War Directory

Washington's first war telephone directory has just come from the press and copies are being distributed today to all branches of the War Department.

The directory, prepared under the direction of the Director of Telephones of the War Department, lists 4,100 names of men and women engaged in war work in an official capacity in Washington.

In addition to the number to be called through the local telephone exchanges, the war directory lists the branch number of the person desired on the line.

Ten months ago the State, War and Navy building branch had 247 connections. Today it carries more than 2,400.

It is the aim of the director of telephones later to compile directories listing the names and telephone numbers of other branches of the Government engaged in work which is related to the prosecution of the war.

The first publication is confined to the War Department and its branches, including the Signal Corps, Corps of Engineers, Ordnance Department, Quartermaster General, Surgeon General's Department, the Adjutant General's Department and the Coast Artillery.

Minnesota to Eliminate Duplication

Northwestern Bell and Tri-State Independent Form Co-operative Alliance

AN affiliation of the Northwestern and Tri-State Telephone companies to operate as one system in the state of Minnesota as a wartime conservation measure was considered by the public utilities committee of the St. Paul Association on March 12.

The proposal came as a surprise, although it developed the plan has been under consideration for some time. A committee of five was named to take up with the railroad and warehouse commission and the telephone companies the question of merging the facilities of the Tri-State and Northwestern Telephone Exchange companies, as follows: A. E. Horn, Edwin White, L. E. Shields, B. H. Schreiber and A. T. Garret.

The committee was named by C. W. Cummins, chairman of the St. Paul Association committee considering the move.

Members of the association conferred with President G. W. Robinson of the Tri-State company and officials of the Northwestern, who agreed that the project is practical, and announced their companies are willing to consider making it effective.

Every city and smaller community in Minnesota will virtually have but one telephone system as the result of negotiations already entered into by the Bell and Independent telephone companies, according to an announcement by Chairman Ira B. Mills of the Minnesota railroad and warehouse commission, which is empowered to regulate telephone service and rates in the state.

The statement followed a series of preliminary conferences before the commission at which G. W. Robinson, president of the Tri-State Telephone and Telegraph Company, and Guy H. Pratt, general commercial superintendent of the Northwestern Telephone Exchange Company, represented the principal competing services.

Work of ascertaining the physical values of city exchanges and rural lines will be continued by the state as a basis for rate making.

TO CONTINUE AFTER WAR

The elimination of duplicate telephone systems is not a war measure, it was stated, but will continue after the war.

It was recently learned the telephone companies had considered the matter among themselves. The commission was finally advised the companies were not averse to such an arrangement.

Patrons and telephone companies alike have felt the pinch of wartimes and the plan therefore is looked upon favorably, it was announced, since its adoption would mean a marked decrease of expense to both.

Telephone companies are pressed by mounting costs of material, maintenance and labor. They are admitted to experience great difficulties in obtaining necessary supplies.

That the proposed unification of the Northwestern and Tri-State telephone systems in Minnesota will involve enormous expense in perfecting the physical connection and will require many months of study by engineering experts, was asserted by Guy H. Pratt, general commercial superintendent of the Northwestern company.

Discussing the plan for the operating consolidation of the two systems, Mr. Pratt said it was fundamentally right that the physical connection be considered, in view of waste and duplication which "must not be tolerated at this time."

"One system, economically operated, can furnish service at less gross total cost per unit than the two systems," he said. "The duplication is found mostly in business offices, and I should say there are 25,000 duplicate stations in Minneapolis in business houses which are paying top rates for both telephones."

He said that the Minneapolis Civic and Commerce Associaition and commercial clubs throughout the state have been agitating the consolidation for some time, and their efforts led to an informal conference with the railroad commission. There have been several preliminary conferences, but it will be necessary that several more hearings be held before a definite statement can be made.

TO ELIMINATE NO EQUIPMENT

The question as to whether the dial system will be abandoned was answered by Mr. Pratt with the statement that neither system has enough facilities to eliminate any equipment. The nature of the permanent system, he said, is contingent upon the economic superiority of either system.

There are approximately 90,000 Tri-State stations in the state which have no access to Bell stations, and the Northwestern company has about 175,000 stations in the state which cannot be connected with the Independent system. If the proposal to connect the lines is carried out it would establish conditions whereby every telephone station in the state may talk with every other station.

Howard Strong, secretary of the Civic and Commerce Association, said that the association was instrumental in bring about the meeting of the telephone officials with the state commission.

"For two months the association has discussed the plan informally," he said. "Last week we called a meeting and the matter was discussed with President G. W. Robinson, president of the Tri-State company, and Guy H. Pratt, general commercial superintendent of the Northwestern company.

"We then presented it informally to the state railroad and warehouse commission. We felt we had no right to make the announcement until we had the approval of the commission. They approved the matter informally, but we were waiting for a more definite approval."

Mr. Strong points out that the government, for many years, has advised competitive telephone systems as an automatic adjuster of rates, but now that rates are generally controlled by the state, the government is evincing a change in attitude and is inclined to approve mergers and consolidations.

DETAILS OF THE PLAN

The plans for one-unit telephone service throughout Minnesota were finally and definitely agreed on at a conference in the state capitol between the state railroad and warehouse commission and representatives of the large telephone companies on March 14. The plan was announced later by Ira B. Mills, chairman of the commission.

The Northwestern Telephone Exchange Company will operate in Minneapolis and the northern part of the state, and the Tri-State Telephone and Telegraph Com-

pany in St. Paul and the southern section. The dividing line will be the northern boundary of Washington, Ramsey, Scott, McLeod, Renville and Yellow Medicine counties.

Because of the large amount of interstate traffic now controlled by the Northwestern company, however, it will retain interstate routes from Minneapolis and St. Paul to Sioux Falls, via Mankato and Worthington, also via Willmar, Granite Falls, Marshall, Pipestone and Blue Earth, and along the river to La Crosse and a line to Hudson over which much interstate traffic is carried.

The first visible result in the consolidation plan, Mr. Mills said, probably will be in Minneapolis and St. Paul. The Northwestern company is expected to continue the manual system in Minneapolis and the Tri-State company the automatic system in St. Paul. Whether the different systems will be universal in the respective zones is not definitely determined, although a prediction was informally made that all telephones eventually will be of the automatic type.

IMMEDIATE TRANSFER IMPOSSIBLE

Present figures indicate that the exchange in the number of telephones will be almost equal, except in the Twin Cities. Because of the large number of instruments and local exchanges in the cities, and the difference in systems, an immediate transfer of the telephone of one company to the other is impossible.

An arrangement for physical connections between the systems can be made, Mr. Mills said, which will permit subscribers of one company to talk to those of the other, and this probably will be done without delay.

"This is a $20,000,000 deal and we must not look for it being closed in a day," said Mr. Mills.

"Telephone supplies ready for shipment here frequently are ordered to France by the government, and these and other conditions should be considered before the public attempts to insist on immediate unification of service.

"The rate and service situation is entirely under the jurisdiction of the commission, and we will insist that reasonable service be furnished at all times and that reasonable rates shall prevail.

"Speaking of the rate situation, with all public service companies under government control we are facing abnormal conditions. The expense of operation has abnormally increased and this may lead to a considerable increase in rates in some localities. I am not saying it will be necessary to increase telephone and railroad rates, but that is a question which the commission and the public will have to face."

It will take at least sixty days to work out the stipulations and draft the program of consolidation. Formal approval of all details must then be obtained from the state railroad and warehouse commission and the Federal trade commission. Federal consent to the plan probably will not be withheld, in view of the government's wish to effect a saving in war materials.

PROPERTY CONSOLIDATION.

These preliminaries completed, there will follow the job of connecting all automatic with manual exchanges. Present Northwestern property in the southern part of the state will be deeded to the Tri-State, and Tri-State property in Northern Minnesota will be deeded to the Northwestern, according to Bell officials. There will be no consolidation of the two companies, but only a division of territory and a consolidation of properties. There is hardly a difference of 1,000 telephone stations between the Bell property in the south and the Independent in the north, so that the exchange will be easy.

Engineers estimate it will take from eight months to a year to connect the automatic with the manual exchanges. When this physical connection is made, most people who now have two telephones will drop one of them—which one, studies now being made will determine. There will, however, be exceptions to this rule.

Telephone directories will have to carry both dial and manual exchange numbers. The entire elimination of one or the other system could not be effected in one sweep without great waste and expense.

To effect the unification in Minneapolis it will be necessary to establish trunk lines between the exchanges. It would mean that after consolidation there would be three exchanges in the downtown section.

The great engineering problem is the study of the flow of traffic which will be necessary to determine the proper connections which must be made between the two exchanges.

Ohio State Affairs

Daniel D. McLaren, formerly of Columbus, now of Cincinnati, was elected a director of the Ohio State Telephone Company at the annual meeting, succeeding William Hardee of Toledo. Stockholders re-elected these directors: Frank L. Beam, Mt. Vernon; Clarence Brown and J. K. Secor, Toledo; Charles A. Otis, Cleveland; James M. Hutton, Cincinnati; H. K. Kiefaber and A. McL. Marshall, Dayton; Henry B. Peters, Lancaster, and Frank A. Davis, F. L. Griffith, F. R. Huntington, C. Y. McVey, Samuel G. McMeen and E. R. Sharp, Columbus. Officers chosen are: Frank A. Davis, chairman of the board; C. Y. McVey, president; F. R. Huntington and Frank L. Beam, vice-presidents; W. L. Cary, vice-president and secretary; H. B. Taylor, treasurer; C. J. Queen, general auditor.

President McVey reported a successful year, although the rising cost of materials and labor has presented a never-ending problem. The next increase during the year was $60,526.66, making the balance December 31, $1,192,091.27. The total assets are $28,249,407.97. The quarterly dividend of 1¾ per cent was declared on the preferred stock, payable April 1 to stockholders of record March 20.

The supreme court has set down the case of the Ohio State Telephone Company against the city of Columbus for hearing on Friday, April 26. The company seeks to put higher rates in effect in Columbus.

New York Earnings

The New York Telephone Company scored a notable increase of gross earnings in 1917 over those of 1916, but increased operating and maintenance costs worked to reduce the year's profit. The total revenue, according to the income account issued yesterday, was $62,961,003, a gain of $5,955,441. Operating expenses of $19,402,079 were about $2,400,000 larger than the year before and upkeep was $1,470,000 higher, with a total of $17,379,544. Taxes also advanced to the extent of $2,000,000, and the net income before paying interest was $20,302,327, a decline of $304,927. Out of the balance of $16,377,490 dividends totaling $10,000,000 were paid.

Combining the telephone company's result with the earnings of associated concerns, the aggregate gross revenue was $98,367,878, a gain of $9,547,000. The total net amounted to $21,300,168, a decline of $2,364,538, and the year's surplus of $6,638,447 was $2,688,443 less than in the preceding year.

Mechanical Working of Underground Cables

Paper Read Before the London Institution of Civil Engineers

BY CHARLES FREDERICK STREET

THE following series of observations were made by the author to ascertain the mechanical conditions governing the use of lead-covered telephone cables. In practice the drug containing the cable is placed at one end of the ducts into which it is desired to draw the cable. This drum is mounted on a spindle on which it is free to rotate, and the cable is then drawn through by means of a hauling-rope (Fig. 1).

The inquiry was made for the purpose of reviewing the mechanical strength of the hauling-tackle used, and also the strength of the cable itself. The points dealt with are:

A determination of the force required to draw cables of varying dimensions into different classes of ducts.

The ability of a lead-covered, air-spaced, paper-core cable to withstand a tensile force without injury.

A comparison of the properties of (*a*) lead and (*b*) an alloy of lead and tin as a sheathing material.

(1) *The Force required to draw Cables of Varying Dimensions into Different Classes of Duct.*—Bearing in mind the large number of varying conditions as to diameter, weight and length of cable and class of duct to be considered, it was desired to obtain some general expression connecting the tractive effort required with the dimensions and weight of the cable and class of dust. The force which it is necessary to apply to a cable to draw it through a duct can be conveniently divided into two parts: First, the force necessary to overcome the friction between the cable and the duct due to the weight of the former; and, secondly, that necessary to overcome the frictional resistance due to the pressure between the cable and the duct owing to the presence of bends in the cable produced in the first place by winding on the drum.

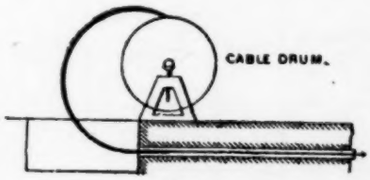


Fig. 1.

The value of the coefficient of friction was determined by laboratory tests with pieces of cable varying from 0.5 inch to 2.5 inches in diameter, and 0.38 to 2.5 lb. in weight, upon a 3-foot length of duct. The speed of the test-piece corresponded approximately with that of a cable being drawn into a duct, i. e., about 10 feet per minute. The results are shown in Table I.

TABLE I.—COEFFICIENTS OF FRICTION FOR A CABLE SHEATH CONTAINING 97 PER CENT LEAD AND 3 PER CENT TIN.

Class of Duct.	*Coefficient of Friction—* *Lubricated Duct*	*Non-Lubricated Duct.*
Cast-iron pipe, coated with Dr. Augus Smith's compound	0.26	0.47
Concrete duct	0.46	0.68
Glazed earthenware duct	0.35	0.44

The lubricant used was a petroleum jelly of the same class as is used in everyday work.

The force which is necessary to overcome the friction due to the weight of the cable only on the duct is T_1 *uwl*, where *u* denotes the coefficient of friction, where *w* denotes weight per unit length of cable, where *l* denotes length of cable with the duct.

A number of tests were next made in which the total force required to draw a cable into a duct was measured. The tension in the hauling-rope which is a measure of the force applied to the cable, is, of course, a minimum when the cable is just entering the duct, and increases as the length of cable in the duct increases. The tension

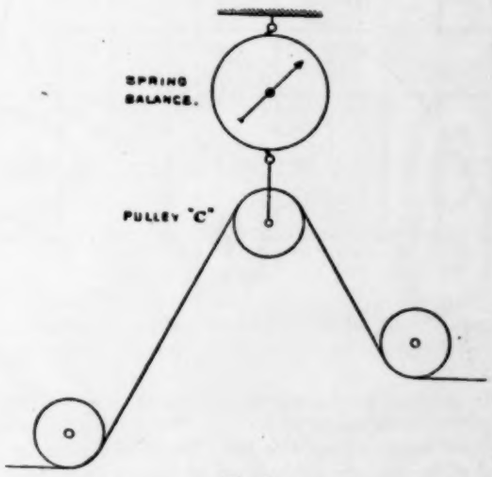


Fig. 2.

was, therefore, recorded for every additional 5 yards of cable drawn into the duct. The cable does not pass through the duct at a uniform speed, but rather in a series of smooth impulses. The hauling-rope gradually stretches and the tension therein gradually increases until the cable moves. The tension which was recorded for each 5-yard length was the average of the maxima reached during that period.

The simplest method of measuring the tension in the hauling-rope is to place the winch at some considerable distance from the end of the duct and to place a spring-balance in series with the hauling-rope. The spring-balance can then be read as it travels along in the space between the end of the duct and the winch. This method was not always practicable owing to the street traffic, and in such cases the winch had to be placed close up to the end of the ducts, and a series of pulleys, as shown in Fig. 2, was employed. This constituted a form of transmission dynamometer, and the spring-balance used read up to 1 ton, and was fitted with a maximum pointer.

It will be observed that this latter method is very flexible with regard to the range of tension which can be measured, for by lowering the pulley *C* and increasing the angle made by the rope at the point *C* the ratio of "tension in rope" to "reading of balance" can be made as large as desired. In no case, however, did the angle ex-

ceed 120°, as it was considered that the accuracy of the result would be affected thereby, because as the reading of the balance increased the position of the pulley would be lowered by the action of the balance, and the angle subtended by the rope at C would be appreciably altered.

In one instance, in which it was contemplated that with the pulley C set as low as was consistent with accuracy the limit of the spring-balance would be exceeded, a double pulley arrangement was adopted. The angle made by the rope passing over the pulley C was carefully

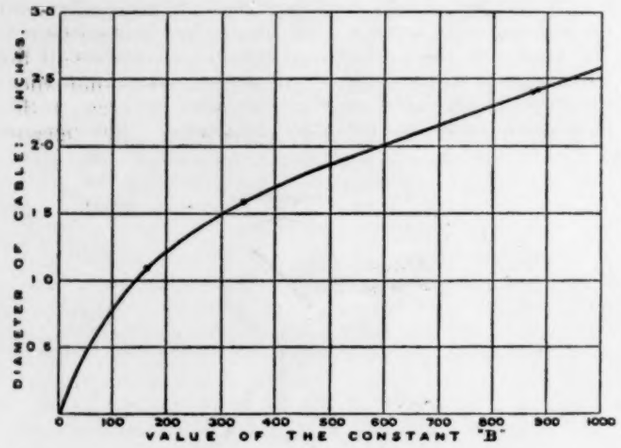


Fig. 3.

measured, from which, together with a knowledge of the reading of the spring-balance, the tension in the rope was calculated.

As the result of a number of tests, it was found that the force necessary to overcome the frictional resistance caused by pressure on the interior of the duct owing to bends or kinps in the cable is given by the equation

$$T_2 = uB \log (100\,l + 1),$$

where B is a factor depending upon the diameter of the cable. Its value for any particular diameter can be determined from Fig 3.

The total force, therefore, is

$$T = T_1 + T_2 = u\,[wl + B \log (100\,l + 1)],$$

where u denotes the coefficient of friction,
l " length of cable within the duct in yards,
w " weight of 1 yard of cable in lb.,
B " a factor depending upon the diameter of the cable and given in Fig. 3,
and T " the force in lb.

For all ordinary calculations the expression $(100\,l + 1)$ can be considered as $100\,l$. The 1 has been added in order that the terminal conditions may be correct: thus, if $l = o$, then $T = \mu B \log 1 = 0$, which is correct; otherwise the result would be $T = \mu B \log o = -\infty$.

This formula applies to a line of ducts having an internal diameter of 3 inches and deviating from a straight line either in the horizontal or vertical plane to an extent considered to be permissible in practice. This deviation from the straight is limited by the imposition of a test which requires that a rigid mandrel 3 feet in length and 2¾ inches diameter can be easily drawn through the ducts.

A line of ducts laid in public streets must, of course, contain bends of a greater curvature than this. Whenever possible, though, an abrupt change in the line of pipes is selected as a point for drawing in the cable in order to avoid drawing round the curve. Where a bent pipe has to be negotiated, the mechanical conditions, for the purposes of this calculation, have been likened to those of a flat belt on a pulley when the limiting ratio of the tensions on each side of the bend is $\frac{T_1}{T_2} = e^{\mu\theta}$, where θ is the angle of the bend in radians, and e is the base of Naperian logarithms.

In order, therefore, to ascertain what additional tension is required to draw a cable round a certain bend, the tension in respect of the cable as far as the bend is calculated and then multiplied by $e^{\mu\theta}$. The result is the tension on the other side of the bend. The difference between the tension on either side of the bend is added to the calculated tension for the whole of the ducts as if it were a normally straight line of ducts.

The relationship between the force applied to the cable and the length of cable within the duct is shown in Figs. 4 and 6. These show how the curve which has been calculated from the formula agrees with the figures obtained by experiment. In the experiments shown on Fig. 6, the line of ducts included two bent pipes of 18 feet radius, and subtending an arc of ⅛ of a complete circle, or an angle of roughly 12°. The curve has been drawn partly dotted for the whole length of the cable as if there were no bends in the duct. The value of $e^{\mu\theta}$ for such a bend with a lubricated cast-iron pipe is 1.053. The calculated tension at A is 780 lb., and at B will therefore be 822 lb. From B to C the total curve is drawn parallel to the dotted one. The tension at D is found as before by multiplying the tension at C by 1.053.

This method is, of course, not strictly correct, as it neglects the force required to bend the cable and to straighten it again. Nevertheless, it will be seen that the calculated curve does not differ very much from the mean position of the points found by experiment.

The ability of a Lead-covered Air-Spaced Cable to withstand a Tensile Force.—The next inquiry was the consideration of the ability of an air-spaced telephone cable to withstand the mechanical tensile loads imposed

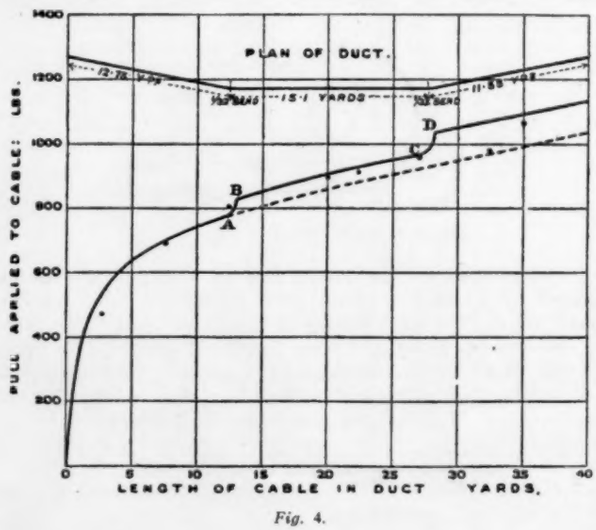


Fig. 4.

upon it, and to ascertain the measure of the assistance which is given to the cable mechanically by the presence of the conductors themselves.

The tensile strength of the sheath, which was composed of an alloy of 97 per cent lead and 3 per cent tin, was determined by a series of tests made by Messrs.

Kirkaldy on tubes of alloy, or, in other words, on cable sheaths. From these tests it was ascertained that the breaking tensile stress of this alloy was 3,980 lb. per square inch.

In practice when a cable is to be drawn into a duct the end of the cable is "dressed." This operation of "dressing" consists in beating the sheath at the end of the cable so that the diameter of the cable is diminished, and the sheath, therefore, embraces the core of conductor wires more tightly. The hauling-rope, i. e., the rope to be used for drawing the cable through the duct, is attached to this prepared cable end by means of what is known as a "grip." This consists of a sleeve composed of plaited steel wire, which is slipped over the prepared end of the cable, and by virtue of its plaited formation tightly grips the end when the hauling-rope is in tension.

A number of short lengths of cable, 100 inches long, were prepared at each end in the manner described, and tested to destruction by the parting of the sheath. Unfortunately, the sheaths of the tested cables were not of the same dimensions as the cable sheaths which were experimented with in the previous tests.

Table II shows (1) the load at which the sheaths of the test cables parted and (2) the calculated breaking load of the sheaths only:

TABLE II.

Number of Wires in Cable.	*Load at which the Sheath of the Test Cable parted. Lbs.*	*Calculated Breaking Load of the Cable Sheath without Conductors. Lbs.*
100	815	1,000
150	1,666	1,145
200	1,750 and 2,500	1,430
300	1,925	1,510
600	2,499	2,890
1,200	4,609	3,940

In the above calculations the breaking stress of the alloy forming the cable sheath has been taken as an average of 3,980 lb. per square inch.

A comparison of the breaking loads of cable sheaths with and without the core of conductors, as shown by

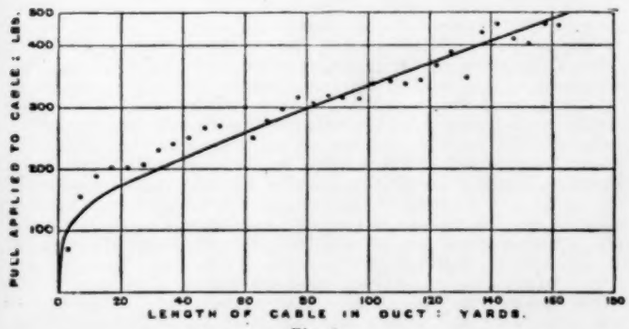


Fig. 6.

this Table, introduces the element of uncertainty to such an extent as to discount any assistance which may be given to the sheath to sustain tension, either by the ordinary friction between the sheath and the core or that obtained by beating or dressing.

It appears probable that the friction between the core and the sheath is very much increased by stretching the latter, and it is feared that to utilize this assistance the cable must be abnormally stretched. That the friction between the cable sheath and the core of conductors may be very considerable is seen from the results of the tests on the 200-pair cable. In this case the sheath parted near one end at a load of 1,750 lb. The load on the test-piece was then increased until a load of 2,500 lb. was reached, when the sheath parted at the other end.

As a result of these tests it is thought that, with the present method of attachment of the hauling-line to the cable, any calculations which are made as to the ability of the cable to resist a tensile force should be based on the strength of the sheath alone, and that the assistance which may be given by the core should be considered as a portion of the factor of safety.

A Comparison of the Properties of Lead and a Lead-Tin Alloy used as a Sheath Material.—The material gen-

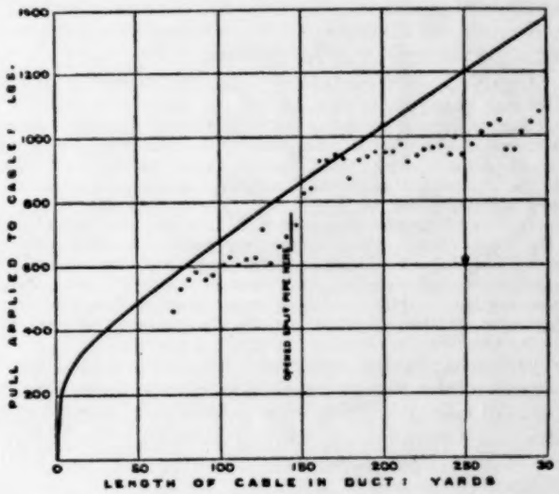


Fig. 5.

erally used for sheathing underground cables is commercially pure lead. The late National Telephone Company, however, used an alloy containing 97 per cent lead and 3 per cent of tin, and experiments on the properties of the two materials gave the results shown in Table III.

TABLE III.

	Lead	*Alloy*	*Ratio of Alloy to Lead*
Tensile strength in lbs. per square inch	2,630	3,980	1.51
Hardness, by Dr. Unwin's method	4.20	5.03	1.20
Pliability: number of alternations before fracture	394	298	0.76

The hardness figure for lead is that given by Dr. W. C. Unwin; that for the alloy was obtained by the same method.

The question of chemical corrosion was investigated by Professor Letts, of the Queen's University, Belfast. Although it is commonly believed that pure lead is less liable to corrosion than the alloy, this was not altogether borne out under Professor Letts' artificial induction of corrosion.

In considering the question of price the relative tensile strength of the two materials must be taken into account. It may be shown that on this basis the alloy will be the cheaper until the price of tin exceeds eighteen times the price of lead.

Splicers and Repair Men Wanted

More than 100 men who can splice telephone cables and repair telephones and telephone wires are wanted for enlistment in the 310th Field Signal Battalion, Camp Custer, Battle, Creek, Mich. Those who enlist must pass the regular army examination. Applications, together with three letters of recommendation, should be mailed to Wharton Clay, executive secretary of the association, 602 Consumers' Building, Chicago.

Would Federalize Columbia Wires

Postmaster General Burleson Answers Senate Resolution

READERS of TELEPHONE ENGINEER noticed in the March number, on page 138, a brief announcement of a government offer fraught with considerable meaning. The paragraph reads:

"The Government notified the Chesapeake and Potomac Telephone Company February 23 that *if the company desired* it would undertake to take over the lines in the District of Columbia and operate them during the war at the present rates for service."

Two days later, February 25, the Senate passed the following resolution:

Whereas, it is reported in the public press that the Postmaster General of the United States offered to take over and operate, in behalf of the United States, the telephone system of the Chesapeake & Potomac Telephone Company, within the District of Columbia: Therefore, be it

Resolved, That the Postmaster General be, and he is hereby, directed to transmit to the Senate the proposition made by him to the Chestpeake & Potomac Telephone Company, and also to transmit to the Senate any information which he may possess authorizing him to make such, or any, proposition looking to the taking over of the operation by the Government of said telephone system.

Following is the reply sent by Postmaster General Burleson to the Senate resolution with reference to the suggested taking over of the telephone system in the District of Columbia by the Government:

HON. THOMAS R. MARSHALL, *Senate of the United State of America.*

MR. PRESIDENT: I have received Senate resolution of date February 25.

In compliance with this resolution I deem it proper to recite the circumstances referred to therein and officially reported by the Commissioners of the District of Columbia sitting as a public utility commission, to wit:

"CHAIRMAN BROWNLOW: I asked the Postmaster General if he desired to be heard in this matter, since I know of the interest of the Post Office Department in the telephone situation. He was not able to be present, but he sent as representing him the chairman of the telephone and telegraph committee of the Post Office Department. Mr. Chance is present and desires to make a statement.

"MR. CHANCE: Mr. Commissioner, my statement is very short. I am here representing the Postmaster General, and he has directed me to say that, if he is given authority, the Post Office Department can take over the entire telephone service within the District of Columbia and operate it without increased charges to the patrons, and without reducing the salaries of the employees, and pay for it out of the surplus revenues of the Postal Service. That is all I have to say."

HISTORY OF SUBJECT MATTER.

With respect to the information upon which the statement made by Mr. Chance was made, beginning with the statement of the undesirable telephone situation prevailing, and threatened, in the District of Columbia, it may be well to briefly detail the history of the subject matter, the measures proposed heretofore by members of Congress looking to its treatment, and the relation of the Post Office Department to such measures, as well as the proposals of the Chesapeake & Potomac Telephone Company itself.

In the Sixty-fourth Congress, early in 1917, bills were introduced in the Senate by the Hon. Thomas P. Gore, of Oklahoma, and the Hon. Atlee Pomerene, of Ohio, and in the House of Representatives by the Hon. David J. Lewis, of Maryland, which provided for the taking over of the Washington telephone system by the Government, with a view to its substantial extension and development to meet existing and future needs. These bills made provision for the development of an adequate telephone service for both public and private needs, as they should arise. The bill of Senator Pomerene was referred to the Committee on the District of Columbia of the Senate, which committee requested the opinion of the Postmaster General as to its merits. The Postmaster General, in response to such request, gave the bill his approval.

HOUSE BILL ALSO APPROVED.

The like bill in the House of Representatives was referred to the Committee on the District of Columbia of the House, and the Postmaster General was asked in like manner by said committee for his opinion on the merits of the bill, as were also the District Commissioners of the District of Columbia. Both the Postmaster General and the commissioners made reply, giving their approval to the measure. If any of these measures had been enacted into law, the present telephone system in Washington, which may be described at this time as deplorable, would have been avoided.

The House bill was made the subject of extended hearings before the Committee on the District of Columbia, which continued so near to the close of the session that no final action was taken on the bill.

MADE INQUIRY INTO EXPENSES.

Meanwhile, with the same objects in view, the Postmaster General caused to be made by telephone experts a careful study and investigation of the telephone situation in Washington, with a view to definitely ascertaining the necessary operating expenses of conducting the system as a part of the Postal Service. These experts reported on the 1st day of May, 1917, that the final cost of a network (including value of the existing plant) embracing 80,000 telephone stations would be $10,862,310. The network of the present system in 1915, the latest previous data, included 54,671 telephones. The larger network proposed would have fully met the needs of the city for both its present and prospective emergencies.

With respect to the costs of operating the telephone system, these experts, after careful study, reported that, including capital, depreciation, and all operating expenses (if conducted by the Post Office Department as a part of the Postal Service), the cost per telephone could easily be reduced more than one-third. The Chesapeake & Potomac Telephone Company estimates the expense per telephone in 1918, without making allowance for capital charges or taxes, to be $38.10, which is grossly in excess of what the cost would be if the service were operated by the Post Office Department. Such was the proposal of members of Congress and the Post Office Department to meet the requirements of a public and private character for telephone service within the District of Columbia.

STATEMENT OF TELEPHONE COMPANY.

In its statements made before the Public Utilities Commission, the Chesapeake & Potomac Telephone Company reports having 71,276 telephones in December, 1917, and it proposes to increase this number to 75,000 during the year 1918, a number of which may prove inadequate. The study made for the Post Office Department by the expert engineers referred to above contemplated a network of 80,000 telephones. Their study was based on the data of the year 1915, it being the latest available, and represented, as stated, 54,671 telephone stations, with a capital of $6,241,134. Thus the addition of an investment of $4,621,176 would have added 25,329 stations to the network, raising it to 80,000 in number and at the same time rendering it susceptible to prompt and economical extension and development. The proposal of the Chesapeake & Potomac Telephone Company for the year 1918 raises its capital to $10,694,001, but raises the number of telephones to only 75,500.

QUANTITY OF SERVICE RENDERED.

The quantity of service rendered in the city of Washington was extremely low before the war, the lowest per telephone reported for any city in the United States in 1914, while the average rate charged for completed calls was the highest for all the cities reporting, with one exception, as is shown by the following table:

AVERAGE CALLS PER TELEPHONE AND AVERAGE RATE PER 100 CALLS IN DIFFERENT CITIES.

	Annual calls per phone.[1]	Average telephone rate per 100 local calls.[1]
New York, Manhattan[2]	962	$4.45
Brooklyn[2]	875	4.21
Washington, 1914[2]	823	4.21
Washington, 1915[2]	888	3.88
Washington, 1917[2]	1,099	3.13
Baltimore[2]	993	3.53
Philadelphia[2]	1,445	2.20

Pittsburgh[2]	1,998	1.52
Cleveland[2]	2,000	1.48
Indianapolis[3]	2,238	1.15
Spokane[2]	2,155	1.08
Kansas City[2]	3,366	1.05
Rochester[3]	2,940	1.04
Plattsburg	2,090	.94
Buffalo[3]	2,710	.77
Louisville[3]	4,027	.69

[1] Not counting toll calls.
[2] Bell system.
[3] Independent.

HALF NORMAL SERVICE HERE.

While Washington is given a service of only 800 to 1,100 calls per telephone, the average calls per telephone in the United States was 2,055, according to the census of 1912, and some of the cities show a phone utilization of more than 3,000 calls per annum. For this half normal service I am informed that the average paid per 100 calls in Washington was $3 to $4, when the average for the United States was 89 cents per hundred for the independents, with a general average of less than $1 per hundred in some of the large cities.

Obviously, the test of any service institution is the amount and quality of service rendered the public, stated in terms of the number of employes and the amount of capital employed to obtain such service.

The committee of the Post Office Department on telephones and telegraphs, which made an elaborate investigation of this subject, the report of which I had the honor to transmit to the Senate on the 31st day of January, 1914, and which was published as Senate document No. 399, second session, Sixty-third Congress, found that the assumption by the Post Office Department of the function of electrical communication would permit of substantial savings and economies through the co-ordination of these two now diversely organized and operated services of communication. They differ only in this, that the railroad or personal carrier bears one communication and the wires carry the other.

BUREAUS NOW MAINTAINED.

The following bureaus or services are now maintained, each independently, by the Post Office Department and the telephone system:

The Post Office.—Postmaster General, four assistants, law department, auditor, treasurer's office, purchasing bureau.

The Telephone System.—President of the company, vice-presidents and directors, law department, auditor, treasurer's office, purchasing bureau.

The commercial account under private management includes such items as advertising, canvassing, promotion, revenue accounting, revenue collecting, collection expense, salaries of general officers and their clerks. These are susceptible of complete elimination by postal methods. Indeed it is not too much to say that their entire revenue collecting and accounting system can be practically displaced under postal methods and the work reduced substantially to one of maintenance and development.

SLIGHT ADDITIONAL EXPENSE.

Much, indeed nearly all, the above duplicating official telephone personnel represent established functions in the Post Office Department, dischargeable by it with slight if any additional expense. There is besides the very considerable item of earnings on investment. Public utility commissions proceed on the theory that private enterprises are entitled to claim if they can earn a return of 8 per cent per annum, which is not unreasonable to private enterprise. Government capital, on the other hand, should cost only about one-half this amount. Taking the savings from unification of mail and telephone communication systems, along with the immense saving in capital charges, I have the fullest confidence in the statement made to the District Utilities Commission as to the results of postal management of the District telephone system if authority be given to unite it with the Postal Service.

In fact, the accomplishments suggested present a very great understatement of what postal policy and postal management can accomplish in operating the telephone system in the District of Columbia.

SUGGESTION NOT NEW ONE.

The suggestion that the Post Office Department enter the field of electrical communication is in no sense new or recent. As Postmaster General, I have made the recommendation in my annual report five successive times. The recommendation was made by my immediate predecessor, and by many other Postmasters General. In the infancy of telephone communication a like recomendation was made by Postmaster General John Wanamaker. Among other things, he stated:

"A year from next March the telephone patent expires, and unless Congress acts promptly to authorize its adoption for communication among the people, it requires no stretch of the imagination to believe that in the next two years one immense syndicate will unite and control all the hundreds of telephone plants of the country, as the telegraph is now controlled, or the two will be united, and then for the next twenty years the most astute attorneys will be legitimately earning large salaries in indignantly opposing the so-called attacks of future Postmasters General upon defenseless vested rights."

How prophetic this statement was; at this time how familiar we are with it; how often did we hear it when there was pending before Congress the propositions for the establishment of the Parcels Post and the Postal Savings?

FUNCTIONS OF COMMUNICATION.

The functions of communication so clearly appertains to the Government that it is provided for in the Constitution of the United States.

Communication is a means primal to the gratification of all human requirements. It should therefore be made accessible to all persons, whatever their fortunes may be, as considerations of public economy will allow. This means that ample facilities should be provided by the Government which is charged by the Constitution with this great function. It means, too, that the service should be provided at reasonable cost, in fact at as low cost as efficient service permits, so that the largest number possible may use it. The Postal System has so realized these great objects, so formulated its rates, that the poorest self-sustaining human being can afford to use any service it performs. The only postal limitation on his communicating from end to end of the Republic is the cost of a two-cent stamp. On the other hand, the use of these great facilities of communicating by electricity is woefully restricted among the masses of the people by the necessities of the interest of private persons who own and manage them.

MAJORITY WITHOUT TELEPHONE SERVICE.

Among the masses of the people, even here in Washington, the capital of the richest country of the world, the majority are shown to be denied this great convenience. The following table on the testimony of the president of the Chesapeake & Potomac Telephone Company, testifying as to the distribution of the telephone service among the residences of the city before the Committee on the District of Columbia of the House of Representatives, speaks conclusively as to the effect of high rates and private control upon this great agency of communication.

100 families paying a house rent—	*Per cent.*
Up to $20, have 10 telephones	10
Up to $35, have 23 telephones	23
Above $35, have 82 telephones	82

It is no criticism of private endeavor to quote the above facts. They represent failures—grave failures in modern communication, but they are failures judged by postal standards, not by the standards of private enterprise. The wealth of the United States is ample to justify a complete telephone service in its capital. Private endeavor does not have the kind of motive necessary for the accomplishment of this or other postal objects. Great organizations of national scope it has built up, in that part of the field of communication which the Government has so long neglected—neglected, I say, but not surrendered either its right or duty to perform. While the postal rates in the United States are the lowest among postal systems the following table, taken from the report of the telephone and telegraph committee on the Post Office Department, shows how postal telephone rates in other countries compare with the private rates in the United States.

RATES IN EUROPE.

Statement of the average rates for nine countries on the continent of Europe:

TOLL TELEPHONE RATES.

Distance in miles	100	300	400	500	700
Continental rate	$0.20	$0.37	$0.39	$0.46	$0.53
Bell rate	.60	1.80	2.40	3.00	4.20

On the long-distance telephone rates it has been stated by one who has made a most searching study of the question that it costs the American as much to ship his communication over the wires, mile for mile, as it costs him to ship a ton of freight on the railways. The telephone rate equals 6 mills a mile, the average railway rate about 7 mills.

It should be added that the aggregate postal revenues in the sixteen great postal systems conducting these as well as other functions of organized communication, shows a surplus profit of 20 per cent in their annual receipts. A reason why the Postal System can achieve cheap rates and provide efficient service is that it has no uneconomic, no wasteful interests to serve. Hence the great disparity of the telephone rates in the United States as compared with those of postal systems, notwithstanding our postal rates are as low or lower. Hence, too, the humiliating knowledge that instead of ranking first in the frequency of our use of the telephone communication we rank low and not high in the use of these services.

The conclusion can not be escaped that private rate making is responsible for the out-of-date and inadequate telephone service, and for its resulting breakdown from congestion of traffic in Washington. And the local company proposes relief only by destroying, through higher rates, even more of the existing traffic of the city. The rates now restrict the use of the phone to about one-half the utilization obtaining throughout the country. Its proposed remedy is to eliminate, by higher rates, a large part of the service that is left.

Finally, I wish to add that there is much other information gathered, studied, and compiled by the Post Office Department, reflecting on the proposition that, if given authority, the Post Office Department can achieve the results stated in the announcement made before the Utilities Commission.

In concluding, I wish to repeat on the basis of the information hereinbefore produced, and as the result of careful studies:

First. That if given authority by the Congress, the Post Office Department can take over the telephone service of the District of Columbia and be able to—

(*a*) Operate it without increased charges to the patrons.

(*b*) Without reducing the salaries of employes.

(*c*) And pay for the system out of the surplus revenues of the Postal Service.

To which propositions I am able to add another:

Second. That within a reasonable time after receiving such authority, the Post Office Department will permanently remove the present congestion of telephone traffic, and bring about a more general use of the lines to both the Government and private patrons.

I have only to further add that so much as might be necessary of the surplus of the Post Office Department, for the fiscal years 1916 and 1917, could nowhere and in no way be more appropriately applied than in giving the Government, in its stress, and the people of the capital city, permanent, adequate facilities for communication and at reasonable rates.

Permit me, also, to direct attention to the fact that there is no Government engaged in the present war—there is hardly a Government anywhere—which intrusts its official secrets and correspondence to unofficial and private carriers.—Respectfully,

ALFRED L. BURLESON, *Postmaster General.*

Representative Hilliard, of Colorado, who read the report for the House District Committee authorizing the taking over by the government of the telephone and telegraph lines in the District, on March 20 introduced in the House a bill for the government to acquire military control of all telephones, telegraph and wire communications in this country by July 1.

This bill provides that the postmaster general shall run the unified wire communication service as a part of the federal postal service.

This measure is drafted somewhat along the lines of the railroad bill. It authorizes the government to acquire telephone and telegraph cable lines by July 1st under right of eminent domain in the form of a lease. This lease would run until 1960, with the intention that the government should become owners of the wire service after that date, but with a specific provision that the government may purchase it at any time.

The Hilliard bill provides that a just rental shall be paid for the property, what is a just rental to be determined by the Interstate Commerce Commission. A sinking fund of 1 per cent on the bonds issued is stipulated.

Representative Hilliard, in discussing his bill, said:

The Washington telephone situation has opened my eyes to the situation throughout the country. The trouble is the extravagant waste in electric communication. We have to maintain three plants and four organizations—the Western Union, the McKay line, the Bell system and the Postal organization—to do the work of communication elsewhere handled by the postoffice over the same wires at the same moment. The bill provides for like unification in the United States.

The people of Colorado have to pay three times as much to telegraph to the east, and to talk here it costs them as much literally as to ship a ton of freight, or about six times as much as postal charges. This is in order to maintain the three extra constitutional organizations.

The government has ignored its duty in this matter long enough. It is its duty under the Constitution to provide adequate means of communication through the people's owned communicating organization, the postal system, and at rates the masses can pay, instead of leaving the subject to multifariously private interests that provide facilities for the fortunate alone.

The people of the west and east, with great distances, have to suffer and their industrial organizations, like the grange and the American Federation of Labor, are asking for relief.

The bill is a modification of the Lewis measure. Instead of a direct compulsory purchase, it proposes a lease, under eminent domain, and thus avoids the necessity of large financing by purchase. To avoid maintaining four separate communicating organizations, it merges and unifies them all in the postal system by taking a lease of the two telegraph and telephone net works.

The owners will become lessors to the government and be paid a rental as 'just compensation' substantially as is being done with the railway.

By eliminating waste of three extra organizations the service can be reduced to a minimum of expense, and, as with its other services, the postoffice can extend it to every home and at postal rates which the poorest can pay.

Representative Hilliard expects to get this measure referred to the House committee on military affairs, and expressed his intention to urge early action upon the measure by Congress.

Taking for granted the sincerity of the clause in the government offer of February 23, which made the condition "if the company desired," it is interesting to read President Theodore N. Vail's statement in his report to the A. T. & T. Co. stockholders:

"To those who look upon government operation as the only remedy for existing or fancied evils of private operation the following assumptions, based on experience, are respectfully submitted.

"If from the net revenues of private operation are deducted all paid in taxes, directly by the corporation and indirectly on the securities by the holders, the balance would be no more than sufficient, if sufficient, to pay government rates of interest on the actual investment.

"The financial credit, that is the balance sheet, and the service credit, that is the dependence of the employe on his employment and the sufficiency and efficiency of service, are the controlling factors in private enterprise.

"The financial affluence and credit of the Government and its immunity from direct control, and the lack of dependence of the Government employe upon his employment, are inseparable, inherent and preponderant factors in government operation. Therefore the desirable factors of economic and efficient operation are wanting.

"Whatever can be done by the Government through direct operation can be done more certainly through control and regulation of private operation, thus combining the potency of the sovereign with the initiative and interest of the subject.

"The attention of the public interested in a proper telephone service is respectfully called to these general statements, which should be fully considered, appreciated and understood."

There are some, even among enthusiastic telephone men, who hold the theory that government ownership of long distance (interstate) lines is inevitable. It should be noted well that the present proposal has to do with local service—exchange operation.

While the plea of the postmaster general for an opportunity to run the telephone business is a perennial affair, and telephone men have become somewhat calloused to it, it must not be overlooked that the present hour in its complexities and emergencies and increasing bureaucratic powers offers Mr. Burleson a closer prospect of success than his department has ever enjoyed.

That the company concerned is a Bell subsidiary is wholly incidental. The situation deserves the attention of all telephone men, whatever their affiliation.

The Bell System's Annual Report

Abstract of the Company's Record for 1917

THAT adequate war service, military, official and commercial, was provided for the United States by the Bell System, was the upstanding fact in the last annual report of President Theodore N. Vail. "The essential feature of Bell service is preparedness, the essential characteristic is dependency," says Mr. Vail, and the record of the Bell Telephone System for 1917 shows how it met the greatest emergency of modern times "to the satisfaction of the Government, without any particular or serious disturbance to the business of the country.

ACTIVITIES FOR THE GOVERNMENT

Immediately upon the declaration of war, precedence was established throughout the system for all Government service, and 12,000 toll operators were speedily trained for this work. Precedence was also established at Washington and over the entire country for the maintenance of existing Government facilities, and the construction of numerous additional facilities for communication. Elaborate plans had been worked out in advance, and work was done in a few weeks that ordinarily would have taken several months.

War has made new centers and new routes of traffic and the increase in toll telephone service in Washington has been greater than the increase during the eight previous years. To meet this condition, new facilities centering at Washington have been provided and the number of radiating lines increased many times. Important additions have been made to the cables connecting the seaboard cities from Washington to Boston.

Five times the toll switchboards at Washington have been increased and further increases are already under way.

Local traffic in the Washington telephone exchange increased many times, which is being met by new or larger central offices and an increase in the operating force which has necessitated the bringing of hundreds of trained operators from other cities.

To supply departmental and inter-departmental service in Washington, a large amount of underground cable has been laid directly connecting widely separated department buildings both permanent and temporary. Several of the departmental multiple switchboards required are large enough for a city of one hundred thousand population.

For use in the national service 15,000 miles of toll wire and 27,000 miles of circuit for telegraph use have been taken from commercial service and devoted exclusively to the use of the Government.

In other sections it has been necessary to provide telephone facilities and toll connections for the National Army Cantonments, National Guard Camps, Division Headquarters of the Army and Navy, Army Posts, Navy Yards, Aviation Fields, Supply, Quartermasters' and Training Camps, munition manufacturers, shipbuilding yards, and various Federal and State camps and headquarters located in different parts of the country. Some of these camps require telephone facilities equal to cities of 40,000 inhabitants. These new centers have required largely increased facilities for connection, including additional transcontinental circuits.

At the request of the United States Coast Guard complete plans for the enlargement of the Coast Guard telephone system were made and the work of reconstructing and extending these lines done. This work includes connecting about 100 lighthouses and 200 coast guard stations, the laying of some 300 miles of submarine cable, the construction of over 650 miles of pole lines and the stringing of over 1,200 miles of wire. The Coast Guard system is now connected with the Bell System.

The Bell System has been called upon to furnish a very large amount of telephone equipment and supplies of every kind, including many special devices for the Army and Navy, both for use in this country and by the American Expeditionary Forces in France.

Fourteen battalions of picked officers and men, trained in telephone and telegraph work, have joined the Signal Corps from the Bell System.

A Division of Research and Inspection for the American Expeditionary Forces in France has been organized and recruited largely from the scientific staff and laboratory forces of the Bell System, which is represented altogether by about 7,500 employes in the various Government activities incident to the war.

TELEPHONS COMPANIES AND SUBSCRIBER STATIONS

The Bell System, as a whole, is made up of the American Telephone and Telegraph Company and associated and connecting companies. The associated, or Bell companies are Bell companies by virtue of contract or license arrangements and financial relations. The connecting companies are independent companies, operating in territory dependent upon them for service, connecting with the Bell companies. Besides the separate systems making up the Bell System, there are many independent companies covering, partially or completely, large areas of territory, operating independently of, not connecting with the Bell companies.

There are in the United States approximately 11,200 separate companies giving telephone service. Of them 37 are Bell companies, 9,129 independent companies connecting with the Bell System, and about 2,000 independent companies not connecting with the Bell System. There are also a large number of rural lines and systems which connect with these companies, 22,299 of which are connected with the Bell System.

At the end of the year the number of telephone stations which constituted the Bell System in the United States was 10,475,678, an increase during the year of 628,486, of which increase 486,040 were owned by the Bell companies and 142,446 were Bell connected stations. Of the total number of stations in the system 7,031,530 were owned and operated by Bell companies and 3,444,148 by local, co-operative and rural independent companies or associations having sublicense or connection contracts; the so-called connecting companies.

In addition to these there are about 1,300,000 stations operated by independent companies not connected with the Bell System.

THE WIRE SYSTEM

The total mileage of wire in use for the exchange and toll service of the Bell companies, not including connecting companies, was at the end of the year 22,610,487 miles, of which 2,760,172 were added during the year. Of the ttoal mileage 19,521,679 miles were exchange wires and 3,088,808 miles were toll wires. Ninety-four per cent of the total wire mileage is copper wire; 13,451,121 miles, or 59 per cent of the mileage, including 964,899 miles of toll wires, is in underground cables, and this percentage is steadily increasing. The under-

ground conduits represent a cost of $110,500,000 and the cables in the conduits $144,100,000, a total in underground plant of $254,600,000.

Attention was called last year to the mileage of "phantom circuits." During 1917, 59,022 miles of "phantom circuits" were added, making 281,016 miles of these "phantom circuits" at the end of the year.

The wire mileage owned and operated by connecting companies is not included in any of these figures. The approximate mileage of connecting companies' toll wires is 410,000 miles, which added to the 3,088,000 miles of toll wires operated by the Bell companies, makes a total of nearly 3,500,000 miles of such wires bringing together in one comprehensive, inter-communicating system all the cities and towns and practically all of the rural communities throughout the United States.

TRAFFIC

Including the traffic over the toll and long-distance lines, but not including connecting companies, the daily average of toll connections was about 1,009,000, and of exchange connections about 30,845,000, as against corresponding figures in 1916 of 890,000 and 28,530,000; the total daily average for 1917 reaching 31,854,000, or at the rate of about 10,600,000,000 per year. This is an average of approximately 100 calls per year for every man, woman and child in the United States.

PLANT ADDITIONS

The net amount added to plant and real estate by all the companies, excluding connecting companies, constituting our system in the United States during the year 1917 was $118,599,462, distributed as follows:

Real estate	$ 13,770,614
Equipment	28,029,466
Exchange lines	41,565,583
Toll lines	25,834,824
Construction work in progress	9,398,975
	$118,599,462

PLANT ADDITIONS OF PREVIOUS YEARS

The net amounts added in eighteen years have been as follows:

1900	$31,619,100	1909	$ 28,700,100
1901	31,005,400	1910	53,582,800
1902	37,336,500	1911	55,660,700
1903	35,368,700	1912	75,626,900
1904	33,436,700	1913	54,871,900
1905	50,780,900	1914	50,045,300
1906	79,366,900	1915	32,863,700
1907	52,921,400	1916	66,224,700
1908	26,637,200	1917	118,599,500

making a total for the eighteen years of $914,648,400.

MAINTENANCE, DEPRECIATION AND RECONSTRUCTION

Statements have been circulated to the effect that the Bell companies had neither fully maintained their property nor set aside from revenue the usual allotments for reconstruction. The following figures are a refutation of such statements:

During the year $94,071,000 was applied out of revenue to current maintenance and depreciation, an increase of $9,515,000 as compared with 1916. Current maintenance increased $6,227,000, averaging 4.3 per cent on the average plant in service, which compares with 3.9 per cent in 1916.

The provision for depreciation of plant during the year was $52,919,000, an average of 5.5 per cent of the cost of plant, and an increase over 1916 of $3,288,000.

Plant which originally cost about $43,000,000, but which had reached its limit of serviceable life, was removed and replaced by new and improved construction, or sold, as compared with $44,000,000 in 1916. After deducting this amount less salvage from the provision for depreciation, the balance, about $33,000,000, increases the reserves for such depreciation and absolescence, which must be provided for out of current expenses, but cannot be currently determined or expended.

GROWTH AND PROSPECTS.

The continued and unprecedented business activity of the country during the past year has thrown on the Bell System a heavy burden of traffic, taxing facilities to the utmost and necessitating the rapid increase of those facilities which is indicated by the statistics.

It was stated in last year's report that the company would carry on the work of new construction at an unprecedented rate during the year, the plans contemplating additions to plant aggregating about $90,000,000. The actual additions, as shown elsewhere, however, amounted to more than $118,000,000, larger than for any previous year by nearly 50 per cent. Subscribers' stations increased by 486,000.

The continued policy of the Bell System for constructing in advance of requirements, partly to provide for emergencies ,and for economical reasons, has again justified itself many times over during the year. In consequence of the absorption of much of the surplus plant into the service last year, the new construction during the current year was to meet the immediate needs of the service, and as far as possible restore the normal surplus. Great difficulties were met in securing the necessary raw materials, supplies and adequate transportation; there was a large increase in the cost of labor and materials; there was necessary to meet the emergency a large toll line construction; all contributing to the increase of the average investment per station from $146 to $153.

It is difficult to estimate what additions will be made to the plant during 1918. Plans have been made aggregating $90,000,000. This is believed to be the maximum requirement; the probabilities are that much less will be expended. The Government's desire for the conservation of men, material and money for direct war requirements and the difficulties of transportation because of priority orders and freight embargoes, make the exact determination of the program impossible.

The demands of the Government in time of necessity are paramount, but the administration and all its officials recognize the importance, both to the Government and the public, of an efficient service, and will co-operate with the companies in their efforts to maintain regular service.

OPERATING RESULTS

The American Telephone and Telegraph Company and associated companies constitute one operating entity, and to understand or correctly determine the actual costs and charges of the telephone service and the ultimate distribution of the revenue, their accounts must be consolidated.

The statement of earnings and expenses is presented in the form called for by the Interstate Commerce Commission's accounting system. In round figures the total operating revenues of the Bell System were $294,900,000, an increase of $30,300,000 or 11.5 per cent over the previous year. Of these revenue depreciation and maintenance consumed $94,071,000, an increase of 11.3 per cent; traffic expenses consumed $68,122,000, an increase of 26.7 per cent; commercial expenses, $28,364,000, an increase of 10.4 per cent; general and miscellaneous expenses, $13,850,000, an increase of 16.4 per cent; taxes assignable to operations, $20,711,000, an increase of 38.9 per cent. The total of all taxes was $21,186,000, which is 2.31 per cent on the outstanding capital obligations or 1.71 per cent on the value of the plant and other assets.

The "total gross income," using the term officially provided by the Interstate Commerce Commission, was $76,524,000, a decrease of $2,829,000, or 3.6 per cent under 1916.

The capital stock, bonds and notes payable of the

Bell System outstanding in the hands of the public at the close of the year, were $917,376,422. The telephone plants stand on the books of the companies at $1,064,982,710 as of December 31, 1917. A number of appraisals of the properties have been made by the public authorities, practically all of which have appraised the value of the properties greater than the amounts carried on the books.

Particular attention is directed to the percentage of net earnings to plant and other assets, which is 5.86 per cent.

The report analyzing the readjustments in salaries and other conditions of service remarks that the service rendered by telephone employes is largely a personal service and that every effort is made to create favorable working conditions. It is the policy of the Bell System to distribute in regular wages to their employes their full proportion of the revenue it is allowed to collect, the maximum that is being paid by others for similar services and such an amount as will secure the very best class of employes.

The plan for employes' pensions, disability benefits and death benefits has been in successful operation for five years and the expenditures have aggregated $7,617,375. The report shows 314 former employes were receiving pensions at the end of the year, and during the year $1,100,368 was paid on account of sickness, $600,737 on account of accidents and $144,019 was paid in death benefits to dependent relatives.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

The net earnings of the American Telephone and Telegraph Company, segregated from those of the Bell System, are shown to be in rough figures, $4,197,000 more than during the previous year. There was a total increase of the Company's assets of $40,234,000, against which was a net increase in capitalization and indebtedness of $31,600,000, showing a net improvement in the Company's financial position of $8,633,000 in rough figures, which is represented by the increase of that amount in surplus and reserves. The number of shareholders of record on December 31 was 86,599, an increase of 16,044 during the year. To these may be added some 33,000 employes of the Bell System who are buying stock under a plan of easy payments. The average number of shares held was 50, and the majority of stockholders were women.

Mr. Vail states that the business is growing, the public is friendly, the decisions of boards of control and regulation without exception have been intended to be fair, and the plant has been maintained at the highest state of efficiency. Altogether he shows that the business of the Bell System is in a healthy condition with assets of over three hundred millions in excess of the outstanding obligations.

After a careful discussion of the peculiarities of the telephone business and the principles involved, he concludes: "Whatever can be done by the Government through direct operation can be done more certainly through control and regulation of private operation, thus combining the potency of the sovereign with the initiative and interest of the subject."

Senator Sheppard of Texas has introduced a bill in the Senate, giving the President power to take over the telegraph, telephone and cable lines and radio stations under the same conditions as the railroads are now being controlled. The purpose of the legislation, he said, was to safeguard channels of communication against German spies.

Automatics for Washington

An automatic switchboard system for Washington will be the answer of the telephone company to those requesting a speeding up of service.

This plan was announced by T. P. Slyvan, assistant to President Bethel, of the Chesapeake & Potomac Telephone Company, at a hearing of the committee on law and legislation of the Federation of Citizens' Associations in the office of the chairman, E. F. Colladay.

The automatic system would allow one operator to do the work of four or more. It would, experts claim, cut down time in obtaining an answer to a matter of seconds.

The great need of the telephone company at present is to find enough girls to continue with the work. Installation of the automatic system would gradually lessen the congestion and give Washington a much more smooth service, in the opinion of experts.

Although an invitation was extended to Merrit O. Chance, postmaster of Washington, to attend the hearing, no representative of the Postoffice Department put in an appearance.

Mr. Sylvan declared that the Western Electric Company had ready the tools and dies necessary for the manufacture of the automatics, and that final plans for manufacture were being drafted.

It is intended at present, he told the committee, that the system be installed first in the downtown section of the city, and that it branch off into the residential section during the months that pass.

Within two years, possibly eighteen months, it is expected that the Washington telephone system will be entirely automatic. The value of the automatic was recognized by the company at rate hearings before the Utilities Commission and the reason for the non-installments of the system was said to be the time which would be spent in such installation. At that time, Mr. Sylvan told the *Washington Herald* yesterday, plans for installation of the automatic in the National Capital were being formulated.

It is thought that the cost of installing this system will run into millions of dollars. No estimate of the final cost of installment has been made yet by officials of the company, although for the last few days conferences between leading engineers and officials of the company have been held.

It was pointed out at the hearing that it would be inadvisable for the Government to attempt installation of automatics within a few months' time, for the buildings now occupied by the telephone company's switchboards which would supplant the manually operated board.

Russian Farmers and Liberty Bonds

Germany has taken possession of several hundred thousand square miles of fertile Russian and Roumanian territory, has confiscated what grains were on the land, and has set the farmers to work raising more grain to be used by German armies. Probably, but not certainly, enough grain will be left to keep the conquered Russian and Roumanian farmers from starving to death while they raise crops for their German masters.

Over in Russia the deluded people thought an honorable peace could be negotiated with Germany, but they know differently now, as they toil in the fields for the kaiser's soldiers. The only way to negotiate a peace with the kaiser is with a bayonet. We have sent our young men over to France to do the negotiating. Let us furnish them with the bayonets, food and clothing while they are using those bayonets. Buy Liberty bonds.

Come on Men 250,000 of You!

Launch a Blow at the Kaiser by Helping Launch a Ship

Who says we can't build ships!

Come on you loyal American Mechanics, masters of familiar trades, and brand this "made in Germany" insinuation by building a bridge of ships to Pershing.

You can't do your country a greater service than by exchanging your good American brawn and skill for good American dollars—in the shipyard. And you'll do as much to win the war as the men dependent upon you in the trenches. Ships, men, are the pivot on which the destiny of this country turns, and Uncle Sam is looking for 250,000 U. S. shipyard volunteers to build them.

Listen!

Every rivet driven in the shipyards brings us nearer to the successful termination of the war.

To do our fair share our shipbuilding program calls for 6,000,000 tons a year, or over a thousand ships. We must have them to win. We must have them to keep the wheels of American industry moving and American labor employed in the factories.

The Man of the Hour

The Shipping Board has the money, the materials and the yards to carry out this 6,000,000 ton program, but it needs men to assure these thousand yearly launchings which will hurl their tidal wave toward Germany. There must be an immense reserve of earnest skilled labor to draw on as fast as plants are completed in the yards and housing provided.

This, then, is the purpose of this message—to ask your enrollment as a shipyard volunteer, for work in the shipyards when needed. Back up Uncle Sam and the millions of your brother workmen by your enrollment.

This does not mean that you are to give up your regular job and rush off to some shipyard which at the moment, may not be able to accommodate you. Quite the contrary! Your enrollment simply shows that you stand ready, when called upon, to do a particular job for a particular wage in a particular place. Everything will be in readiness for you, and you will lose no time.

And so highly does the Government think of your services that you are placed in a deferred class in the draft, as long as you are working on ships. The War Department, by arrangement with the Emergency Fleet Corporation, accepts shipyard work as a substitute for military service. That's how important Uncle Sam considers ship building and the men engaged in it.

"But," you say, "I've never worked on shipbuilding."

That's exactly why Germany thinks that Amer-

ica cannot build ships. Germany knows that there are not enough men in America who have actually worked on ships to make more than a tenth of the ships we need if we are to do any fighting worth while.

Here is where you American workmen can fool the Kaiser.

Ships are not things of mystery; they are merely big buildings afloat—the product of everyday skill and industry—and the American Mechanic (hats off to him) can build them.

Familiar trades—**your** trade—are the ones that build ships; and almost all trades are represented. Two-thirds of the occupations used in shipbuilding are common to other industries, like boiler making, car building, bridge building, carpentering, machine shop work, etc. The list given later indicates some of the classes needed. Read it carefully and see how you qualify.

If you possess the right sort of training now is the time to rally around this movement and wear a Badge of Honor. This button, issued by the United States Shipping Board, shows that the wearer, through enrollment in the United States Shipyard Volunteers, has placed the welfare of the Nation above all else and stands ready by his labor to help throw across the seas a bridge of ships by which the armies of the United States can pass to do their duty on the fields of France.

To wear this button is a sign of distinction. It truly stamps the owner as the **man of the hour** in whose hands rest the happiness and security of every man, woman and child in this country.

This Is Your Badge of Honor
Wear It Proudly

Come on men—250,000 of you! Your Government is asking that you answer the rattle of German machine guns with the rattle of the riveter. It is asking you, for the present, to prove that you are the marrow of Americanism by going on record with an expression of your willingness to help build ships where you are needed. And it meets you halfway with good wages and deferred class in the draft with all honor.

Can you turn a deaf ear to the call? Where can you qualify in the following list?

Acetylene and electrical welders
Asbestos workers
Blacksmiths
Anglesmiths
Drop-forge men
Flange turners
Furnace men
Boiler makers
Riveters
Reamers
Carpenters
Ship carpenters
Dock builders
Chippers and calkers
Electrical Workers
Electricians
Wiremen
Crane operators
Foundry workers
Laborers, all kinds
Loftsmen
Template makers
Machinists and machine hands, all sorts
Helpers
Painters
Plumbers and pipe fitters
Sheet-metal workers
Coppersmiths
Shipfitters
Structural iron workers
Riveters
Erectors
Bolters up
Other trades
Cementers
Crane men

Clip the Coupon and Get the Full Story

Edward N. Hurley, head of the United States Shipping Board, is the mouthpiece of Uncle Sam in this call for shipyard volunteers. He has complete information on hand, ready to mail you, regarding method of enrollment and other details you may want to know. The coupon below is here for your convenience in writing. Don't delay. Fill in the information asked for, clip and mail. Your action in this matter will bring you full particulars.

Show that you are *interested* by doing this now, while the coupon is before you.

Edward N. Hurley, Chairman,
U. S. Shipping Board, Washington, D. C.

I wish you would send me at once further information, telling me how I can enroll as a member of the U. S. Shipyard Volunteers of the Public Service Reserve for employment in shipyards and so help win the war.

My Trade is.....

My Name is.....

Street Address.....

Town.....State.....

Mentioning Your Competitor

Are We Facing a Revolution in Methods of Selling Merchandise?

By ELTON J. BUCKLEY

IF THE Federal Trade Commission at Washington succeeds in certain prosecutions it has just begun against business men, we will be facing a revolution in business methods, for certain practices will become taboo that have had the sanction of immemorial custom, and in some cases, of favorable court decisions.

This especially applies to a prosecution which the Commission has begun against Sears, Roebuck & Co., the Chicago mail order house, which does an interstate business all over the United States. Understand that the Federal Trade Commission can only prosecute interstate commerce transactions. Practices and transactions carried on wholly within a State or beyond its reach.

I have obtained an official copy of the complaint against Sears, Roebuck & Co. and here present it, as the foreword of what I believe I have truthfully characterized as an attempted revolution:

PARAGRAPH VI. That the respondent, Sears, Roebuck & Company with the purpose, intent and effect of injurying and embarrassing and discrediting its competitors, for more than two (2) years last past, has circulated catalogues throughout the various States and Territories of the United States, the District of Columbia and in foreign countries, among customers and prospective customers of competitors, containing certain advertisements, wherein it is represented that:

(*a*) the quality of goods, wares and merchandise handled and sold by its competitors is inferior to that of similar merchandise sold by respondent;

(*b*) certain of respondent's competitors do not deal justly, fairly and honestly with their customers;

(*c*) respondent can and does buy its commodities in markets which are not accessible to its competitors, and by reason thereof is able to give customers better advantages in quality and price than those offered by competitors;

and that such advertisements and statements are false and misleading and calculated and designed to deceive the trade and general public.

Included in this prosecution was a complaint against that well-known scheme used by all mail order houses, of offering some staple such as sugar way below the market when purchased with certain other goods. I have no intention of discussing that; what I want to discuss is the fact that the Federal Trade Commission is prosecuting a retail dealer because he gave his customers to understand that his goods were better than his competitor's; that certain of his competitors weren't treating their customers fairly, and that he bought goods in markets more favorable than the markets his competitors bought in.

The prosecution is brought under the Federal Trade Commission Act, which forbids "unfair competition."

The important thing about this is that every business man who advertises, whether manufacturer, jobber or retailer, is doing these things every day, and has always been protected in doing them—if they stayed within certain limits—by the general custom and even by the courts.

Of course, if one's representations that his competitor's goods are poorer than his, pass certain limits, they are illegal, and the maligned competitor has an action against him for trade slander or libel, as the case may be (slander if the words are spoken, libel if they are written). But there is no difference between saying that your goods are better than your competitor's and saying that your competitor's goods are poorer than yours. Of course, if the representations you make about your competitor's goods are true, you have a right to make them.

There is a case in which a furniture dealer advertised a solid mahogany bedroom set, "positively of the quality always selling for $150," for $116.50. On the next day a competitor said in his own advertisement that: "the solid mahogany bedroom set advertised yesterday by a competitor as $150 value was in part veneered and had never been sold for more than $100."

A law suit resulted, the first advertiser claiming to have been libeled. He got a verdict, the court saying that the reflection upon the first man's merchandise went far beyond the ordinary limits of competition and advertising rivalry. But such things have been said *generally* from time immemorial, with no attention from anybody. I have no knowledge of how specific Sears, Roebuck & Co. were in their statements about competitors; if they have made the usual general statements that everybody makes about their goods being better than competitors' —or competitors' being poorer than theirs—they cannot be successfully attacked for it, in my judgment, unless the Federal Trade Commission can overturn the settled law of the country.

Everything I have said above applies also to Clause B in the charge, i. e., that Sears, Roebuck & Co. have represented in their advertising that "certain of their competitors do not deal justly, fairly and honestly with their customers." How can a prosecution for a thing like that get anywhere, remembering that some of *everybody's* competitors don't deal justly, fairly and honestly with his customers? If Sears, Roebuck & Co. were specific in their statements, pointing directly and unmistakably to certain competitors, then there may be something in the charge. If they simply glorified themselves, pointing out like the Pharisee, how much fairer and quicker and squarer they were than their competitors, I repeat that they cannot be convicted unless the settled law of the land is to be overthrown. And they cannot be convicted at all if what they said was true.

The subject matter of the third charge has also been passed by as dealer's talk. Literally thousands of sellers of merchandise are fond of representing in all sorts of ways that they possess mysterious and fruitful sources of supply denied to their competitors, and that is why, etc., etc., etc. Nobody who does this is very specific, therefore the matter has aroused little or no attention. But it should arouse attention now that the Federal Trade Commission has officially denominated it unfair competition and has prosecuted somebody for doing it.

Apropos of this subject, the Federal Trade Commission, I am informed, has also begun prosecution against thirty-eight other concerns, all manufacturers, who are charged with unfair competition "because they systematically and on a large scale" gave employes of customers, prospective customers and competitors' customers gratuities such as liquors, cigars, meals, theater tickets, valuable presents and entertainments. Here is another good old custom of the trade forced to don a sinister guise as "unfair competition."

(*Copyright, March, 1918, by Elton J. Buckley.*)

Loading Coils versus Repeaters

Properly Designed and Correctly Installed, Loading Coils Are Adequate for All Long Distance Work

BY W. N. FURTHMANN

IN the March issue of TELEPHONE ENGINEER a discussion was advanced that tended to show the necessity of providing a thermostatic device that would overcome the tendency of a repeater transmitter to pack. It was also pointed out it had been found necessary to provide an electro-magnetic device that would also assist the good offices of this thermostatic device. Since both of these essential features were finally incorporated in our patent it is considered advisable to illustrate the operation of the electro-magnet from an electrical standpoint before proceeding to discuss the mechanical features of both devices.

In order that no question may arise as to the necessity of such apparatus in connection with the prospective use of a repeater in a long distance circuit the important features of Mr. Shreeve's patent No. 1,159,603, dated November 9, 1915, are outlined as follows:

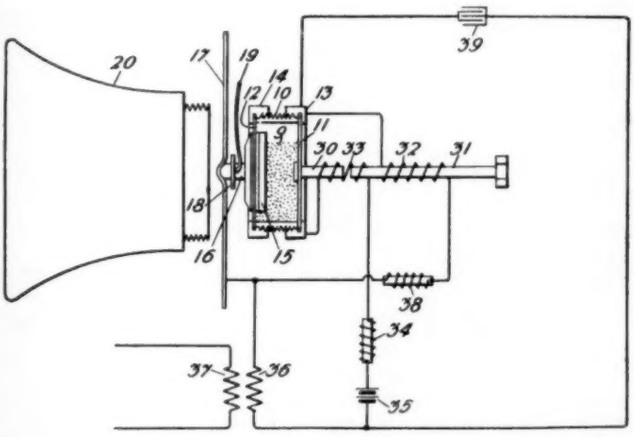
In accordance with this invention, a differentially wound electromagnet is provided in operative relation to the microphonic device. Means are provided whereby an increase or decrease of resistance of the resistance varying medium controls the flow of current through the differential windings of the electromagnet, causing said electromagnet to react upon the microphonic device to control the contact relation of the resistance varying medium.

For a more complete understanding of this invention, reference may be had to the accompanying drawings, wherein—

Figure 1 is a skeleton view of a transmitter embodying this invention, and Fig. 2 is a skeleton view of a repeater embodying this invention.

As shown in Fig. 1, the transmitter may be of the usual granular carbon type having a granular carbon transmitter button composed of an externally threaded cylindrical member *10*, across the open ends of which are flexible members *11* and *12* held in place by means of internally threaded clamping rings *13* and *14* which engage said threaded member *10*. The member *11* forms

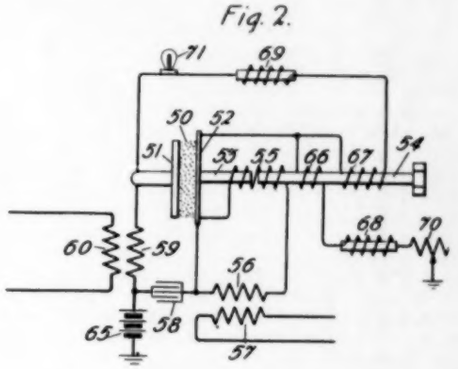
Fig. 1.



the back electrode of the transmitter. Granular carbon *9* forming the resistance varying medium is contained within the chamber just described. To the member *12* is secured a front electrode *15* having an outwardly extending stem *16*, the end of which is in contact with a diaphragm *17*. The stem *16* is provided with a shoulder *18* against which rests one end of a spring *19*, which insures proper contact being maintained between said stem *16* and said diaphragm *17*. *20* represents the usual transmitter mouthpiece. The foregoing description applies to one form of an ordinary carbon button transmitter which, for convenience, has been used in connection with the illustrating of one form of this invention. The invention herein embodied will now be described in detail.

To the member *11* is secured a pole piece *30* which cooperates with a core *31* of an electromagnet. The pole piece *30* and the core *31* are provided with windings *32* and *33*. These windings are opposed, *32* being in shunt with the resistance varying medium *9* of the transmitter, and the windings *33* being in series therewith. One terminal of the winding *33* is connected to the back electrode *11* and the other leads through an impedance coil *34* to one side of battery *35*. The other side of battery *35* may be connected to the diaphragm *17* through an induction coil primary *36*, secondary winding *37* of which is connected with a telephone line. One terminal of the winding *32* is connected to the back electrode *11* and the other may be connected through an impedance coil *38* to the diaphragm *17*. The impedance coils *34* and *38* are in series with the windings *33* and *32* respectively, in order to prevent the passage of alternating currents through said windings. A path for alternating currents is provided through a condenser *39*, which shunts the windings *32* and *33* and the impedance coils *34* and *38*.

Fig. 2.



In microphonic elements, it has been determined that the resistance of the resistance varying medium varies between very wide limits. When the resistance is at the lower limit, the medium is said to be in a "packed" condition, whereas when at the upper limit, it is said to be in an "over-sensisive" condition. Now, it has furthermore been determined that the efficiency of a microphonic element is greatly increased if the fluctuations of the resistance of the resistance varying medium be confined to closer limits. By the use of this invention, this result is accomplished with the accompanying increased efficiency of the element.

With current flowing through the microphonic element, there may be an increase or decrease of resistance of the resistance varying medium depending upon the condition of said medium. Assuming that an increase in resistance results, there is immediately an increased flow of current through the shunt winding *32* and a decreased flow through the medium *9* and the series winding *33*, which, due to said windings being opposed, react upon the member *11* to move said member inwardly, thereby increasing the pressure on the resistance varying medium *9*. Increase of pressure on said medium *9* causes the resistance of said medium to be decreased. Should there be a decrease of resistance of said medium, there would follow a decreased flow of current through the shunt winding *32* and an increased flow through said medium and the series winding *33*. This would necessarily result in the pull on the member *11* being increased, allowing said member to move outwardly and to decrease the pressure on the medium *9*. Decreasing the pressure on said medium causes an increase of the resistance thereof. It will be seen, therefore, that when there is a tendency for the resistance of the resistance varying medium *9* to either increase or decrease, there is an immediate reapportionment of current through the shunt and series windings *32* and *33*, causing a reaction upon the member *11*. In this way the resistance of the resistance

varying medium *9* is controlled by regulating or controlling the intimacy of contact of the material of which said medium is composed.

Referring to Fig. 2 which illustrates a repeater embodying this invention, *50* represents resistance varying medium, and *51* and *52*, respectively, represent front and back electrodes of a microphonic or transmitting element of the repeater. Secured to the electrode *52* is a pole piece *53* which co-operates with a core *54* of the receiving element of the repeater. A receiving winding *55* of the repeater is wound over the core *54* and the pole piece *53*, and is in series with an induction coil secondary *56*, the primary *57* of which is in the incoming telephone line. The repeater is provided with a local transmitter circuit comprising the front electrode *51*, the resistance varying medium *50*, the back electrode *52*, a condenser *58* and an induction coil primary *59*, the secondary *60* of which is in the outgoing telephone line. One terminal of the induction coil primary *59* is also connected to one side of a battery *65*, the other side of which is grounded. The core *54* also carries a winding *66*, which is in series with the resistance varying medium *50*, and a winding *67* in shunt with said medium. In order to prevent the flow of alternating current through the series winding *66*, an impedance coil *68* is placed in series therewith, and for like purpose an impedance coil *69* is placed in series with the shunt winding *67*. In order to initially regulate the flow of current from battery *65*, through the resistance varying medium *50*, shunt winding *67* and series winding *66*, a variable resistance *70* is placed in series therewith.

It will be seen that the intimacy of contact of the material of which the resistance varying medium *50* is composed is controlled in the same manner as is that of the resistance varying medium *9* of Fig. 1. It has been determined that the efficiency of the microphonic element may be still further increased by placing a resistance *71*, having a negative temperature coefficient in series with the shunt winding of the device. This resistance *71* has such characteristics that upon an increase in current therethrough the resistance is reduced, thereby permitting a greater flow of current and an increased pull on the electrode of the transmitting element. With a decrease of current through this resistance *71*, there is an increase of resistance, resulting in a reduction of current through the circuit and a decreased pull on the electrode of the transmitting element. It is obvious that said resistance *71* may be readily included in series with the shunt winding *32* of Fig. 1.

The claims in this patent are of particular interest in pointing out the use of a resistance having a negative temperature coefficient. In this connection the student will remember the lamp regulating device patented by Claude D. Enochs and assigned to the Vote-Berger Company formerly of La Crosse, Wisconsin. While the writer does not question the successful operation of such a device, for the sake of argument it is necessary again to emphasize the point that many devices are being continually added to a repeater in order to overcome its many inherent defects that are brought out forcibly under actual operating conditions. This is of value not only to show the final cost of a complete repeater station, but also its complication as an operating device and its consequent high maintenance costs as compared to loading coils that are designed to prevent magnetization.

As we progress it will be shown that in operating a repeater station it is necessary to provide an adequate volume of receiving current for supervisory purposes. In providing such current it is necessary to do so without shunting transmission and without unbalancing the repeater circuit. An attempt was made to accomplish this by providing a supervisory coil having one receiver winding in inductive relation to a plurality of line windings so that any difference in phase of the currents or current variation on opposite sides of the repeater will be readily indicated and reactive line disturbances obviated.

In previous articles it has been shown that it is necessary to provide efficient means for regulating or adjusting the repeater to operate on particular line combinations. In this connection it will be of interest to note that in addition to these natural variables it is also necessary to compensate for a fluctuating battery voltage due to charge and discharge and for the high accumulative resistance of the repeater carbon button due to its continuous use. It will be shown that means for accomplishing this object consisted in placing a variable resistance in series with the winding of the magnetization coil and transmitting element of the repeater. By means of this resistance and a slide key it was proposed to reverse the poles of the receiver, thus changing the phase relations of the input and output currents to meet the conditions of line unbalances.

It has also been continuously illustrated in our discussion of a repeater that it was only practical to add auxiliary apparatus to a repeater circuit by placing such apparatus in the center of the system. In considering the use of a suervisory relay therefore it was necessary to wire it in shunt of the repeater bridge. Unless this were done it would be evident that it would not be equally sensitive to ringing currents from each side of the repeater. When it is pointed out that this supervisory relay in turn controls a slow acting relay, equipped for this purpose with a copper collar, in turn operating a suervisory lamp and that this relay must not be affected by the momentary impulses of current brought about by the operation of telegraph apparatus on the line, conclusive evidence is at hand for bearing out the conclusion that a repeater is a very complicated piece of apparatus and that its circuit requirements are even more so.

Further emphasis is added to this conclusion when it is understood that the lag of the transmitter element due to the inertia of the many movable parts causes the repeater current to be approximately 90 degrees behind the operating current. This phase lag in the current will bring about an unbalance condition between the line and repeater circuit no matter how carefully protected from unbalance they may be.

It will also be clear that when such a condition is brought about the currents in these divisions will cancel each other. Means must therefore be provided to bring about a reversal of the polarity of the receiver, so that the phase relation of the repeater current will co-act with that of the operating current in order to produce the best conditions for talking.

In the various articles of this paper an attempt has been made to lay the subject matter before the student in as simple a manner as possible without mathematics and intricate formula. Requests have been received from several readers who are technically inclined for a formula that will briefly explain the input and output relation of an efficient audion repeater. Since recent developments in the art have borne out the conclusions of these articles that a thermionic repeater is more efficient than a repeater of the Shreeve type, it is proposed to submit the requested formula as applying to the former type of repeater.

It should be borne in mind, however, that such formula is entirely theoretical. In submitting such data the writer does not concede that the thermonic repeater overcomes all of the inherent defects of the Shreeve type. As a matter of fact, it will be shown that the electrical problems to be overcome are as apparent in this type as in any other and that a loading coil on this account if for no other is more efficient, economical and practical than even the most improved type of Audion repeater. In our discussion of such repeaters it will be shown also by means of the patents that the inventors of such repeaters recognize the many difficulties involved in developing a repeater even of the improved type that would

meet all of the problems involved in commercial manufacture, everyday operation and maintenance conditions.

A thermonic repeater is an evacuated vessel having its output electrodes contained therein. The following formula also relates to the so-called mercury arc type of repeater. In connection with the study of this formula the reader will be interested to note that such data also applies to repeaters that are used in cascade foundation.

The energy amplification of a repeater may be increased without "singing" by applying a fraction of the output energy thereof to the system to be amplified again, the fraction being less than the ratio of energy so applied to the additional output developed.

The application of this principle is of especial advantage where a series of two or more repeaters are connected in cascade formation, or where it is desired that the system be directly connected between an incoming line and a receiving line or recorder without the use of transformers. With the repeaters connected in cascade formation a fractional part of the output energy of one of the repeaters may, without the use of a transformer, be applied in phase relation with the original input energy to a preceding repeater in series, thus establishing a system in which two or more repeaters are working one into another in cyclic order. The system as a whole then becomes one that requires no transformers and is therefore applicable to direct currents and also to low frequency alternating currents.

For any type of repeater the energy amplification may be defined as the ratio of the available energy in the output circuit to the energy consumed in the input circuit. Thus if unit energy applied to the input produces energy A in the output then A is its amplification under normal conditions, a repeater so constructed that any desired fraction of the energy in the output circuit can be applied to the input in such a way as to be amplified again into the output but so as not to affect the circuit normally connected with the input. Let the fraction of the output energy thus fed back be given by $\frac{R}{A}$ where $R<1$. Suppose unit energy applied to the input of such a repeater an amount a appears in the output. Of this $\frac{R}{A} \times A = R$ goes back into the input and $A-R$ is available. The energy R fed back is amplified to AR in the output. Of this $\frac{R}{A} \times AR = R^2$ returns to the input and $aR-R^2$ is available. The process continues as shown in the diagram.

Initial

Input	Output	Available output
I	A	$a-R=(a-R)\times 1$
$\leftarrow$		
R	aR	$aR-R^2=(a-R)R^2$
$\leftarrow$		
R^2	aR^2	$aR^2-R^3=(a-R)R^2$
$\leftarrow$		
R^3	aR^3	$aR^3-R^4=(a-R)R^3$
$\leftarrow$		
R^m	aR^m	$aR^m->^m+1=(a-R)R^m$

Total available output $A=(a-R)\ (I+R+R^2+\ldots\ldots R^m+\ldots\ldots)$

a being available output for unit input is the amplification of the repeater under these conditions. Since $R<1$ R^m approaches zero as m increases and the sum of the series in the second factor is finite. That is a definite input energy causes a definite output so that the amplification has a definite value. It can easily be seen that the sum of the series is $\frac{1}{1-R}$ so that $A=\frac{a-R}{1-R}$. The amount by which the original amplification is multiplied or $N=\frac{A}{a}=\frac{\frac{1-R}{a}}{1-R}$. R a is in general small compared with 1 since $R<1$ and a is large for an efficient repeater. So by making r very nearly 1, N may theoretically be made as large as we please.

In case R be made equal to or greater than 1, the above series becomes divergent and its sum infinite. In other words, once started, the output energy becomes independent of the input and continues increasing until checked by some other cause. In the case of alternating currents it will be clear that for a given circuit the impedances are such as to make R greater than 1 for a particular frequency or a group of frequencies. The condition is absolutely bound to result in the singing or howling of the repeater at some of those frequencies.

It is claimed that the conditions to be met in the application of the above principle are first, the change produced in the output must be in the same direction as the change producing it and second the fraction of the output on the input must be under control and if a wide range of frequencies is to be amplified without distortion it must be fairly constant over the range. It is also claimed that the first condition can be met with an audion or repeater having similar characteristics, by the use of a second audion of the voltage transformer type which it is claimed will, when connected in series, accomplish the necessary change of phase for all frequencies.

With respect to the second condition it is claimed that the fraction of the energy fed back is a function of the impedance of the output circuit which in turn is a function of the frequency.

For work in which a narrow range of frequencies whether high or low is to be amplified r can be adjusted on the basis of the impedance at that range of frequencies care being taken that it be not greater than 1 for any other frequency so as to avoid accidental singing or howling of the repeater.

In order that absolute proof of these defects of thermonic repeater of the approved type may not be questioned a description of R. V. L. Hartley's invention, patent No. 1,218,650, dated March, 1917, will be produced in a future article. It will also be shown by a reproduction of Dr. Campbell's patent, No. 1,277,114 and dated May 22, 1917, that in his patent for a wave filter or a series of wave filters in combination Dr. Campbell did not agree with Mr. Hartley in regard to the method or system that should be employed for overcoming the singing or howling of a repeater.

The Bell Telephone Company of Canada reports for year ended December 31 last net earnings of $1,973,000, equal to 10.9 per cent on the outstanding common stock, compared with $2,469,241 in 1916. The company's final surplus amounts to $2,181,027, as compared with $1,647,955 last year.

War Courses for Telephone Men

Federal Board for Vocational Education Offers Intensive Training

A WAR training course for electricians and telephone men needed for the United States Army has just been published by the Federal Board for Vocational Education. This course, it is planned, will be given to drafted men, enlisted and detailed on subsistence and pay to schools co-operating with the Federal Government in the preparation of mechanics and technicians for military service.

The course consists of 36 lectures and four class room, field and shop units on electric wiring, testing, motors and generators and telephone work. The instruction book is known as Bulletin No. 9. Similar bulletins for training enlisted men in various trades have been prepared by the board and will be announced upon publication. Any of these booklets may be had free on application to the Federal Board for Vocational Education, Ouray building, Washington, D. C.

COURSES FOR TELEPHONE MEN

Three short unit courses for telephone men are outlined here.

Unit E-5.—Construction and repair of telephone lines.

Unit U-6.—Repair and adjustment of magneto telephone apparatus.

Unit E-7.—Cable splicing.

The courses for telephone men are somewhat more distinct from each other than the courses for electricians. For this reason, the manner of conducting them is somewhat different. Instead of having the three classes meet together for classroom instruction, four hours each day are to be devoted to study and recitation and four hours to field work.

UNIT E-5—CONSTRUCTION AND REPAIR OF TELEPHONE LINES

The outline for this course is based on the assumption that one instructor is available for every 24 men to be trained. It is further assumed that each group of 24 men is subdivided into four squads of six men each and that there is sufficient material and equipment for each squad to do the work as outlined independently.

DAILY SCHEDULE

8:00 to 10:30, study period.
10:30 to 12:00, recitation.
1:00 to 5:00, field work.

Study period.—Assignments given from textbook paralleling field work as nearly as possible.

Recitation period.—General discussion of study-period assignments and demonstration of tools and equipment to be used in field work.

Field work.—Instruction given on lesson basis. Schedule of lessons given below.

Lesson 1.—Locate line and dig holes for a line one-half mile long. This line to include one right-angle corner, one road crossing.

Lesson 2.—Frame, distribute, and set poles in line.

Lesson 3.—Install anchors and guys for two dead-ends, one corner, and one road crossing.

Lesson 4.—Place brackets and cross arms on poles and string as many wires as have been provided for by the brackets and cross arms which have been placed.

Lesson 5.—Install telephones on the lines put up in Lesson 4, so that there will be individual and party lines on both grounded and metallic circuits.

Lesson 6.—Arrange to connect these lines together when desired, so that communication may be carried on between stations on different lines. If any interference should exist due to induction, attempt to eliminate same by installing repeating coils or cutting-in transpositions, or both.

Lesson 7.—String one-fourth mile of messenger wire on poles in this pole line, so that it may be used for supporting cable.

Lesson 8.—Hang some 25-pair cable in place on the messenger, which has been put up for this purpose.

Lesson 9.—Test and locate as near as possible cases of trouble on the open-wire lines with a lineman's test set.

Lesson 10.—Test for and locate some cases of trouble in the cable with a "fault finder."

Lesson 11.—Let a number of open wires be broken and others grounded. Locate these breaks and grounds and repair the lines, so that communication may be established as soon as possible.

Lesson 12.—Let some of the guys be loosened, so that some of the poles are pulled out of alignment. Pull these poles back to their proper places and put on new guys.

Lessons 13 and 14.—Dismantle aerial construction.

Lessons 15 and 16.—Build and dismantle a telephone line carrying 30 or 40 wires, using type H construction.

Lesson 17.—Build and dismantle a line carrying two wires, using tripod construction.

Lesson 18.—Dig trench and lay some 25-pair cable in ground without conduit.

Lesson 19.—Select a number of points to be connected together with telephone lines temporarily but quickly. Run these lines into place and install the telephones.

Lesson 20.—Establish communication between several points, using insulated wire in ground and service buzzer for communicating.

Lesson 21.—A study of telephone sets for the purpose of familiarizing the outside man with some of the common faults of telephones and their remedies.

Lesson 22.—A study of the magneto switchboard for purpose of familiarizing outside men with this equipment.

Lessons 23 and 24.—Distmantle all equipment which remains in place and check up material and tools on hand.

TOOLS AND MATERIALS NECESSARY FOR UNIT E-5

The following tools should be available for each squad of six men.

	Each.	Total.
2 24-inch canvas tool bags	$ 5.50	$ 11.00
2 22-inch handsaws	2.00	4.00
1 24-inch framing square	1.25	1.25
1 2-inch framing chisel	1.25	1.25
2 12-inch sweep ratchet braces	4.50	9.00
1 1⅛-inch auger bit	1.00	1.00
1 ⅞-inch auger bit	.90	.90
2 6-inch bit hand axes	.75	1.50
2 round point, long handled, digging shovels	1.75	3.50
2 digging spoons	1.75	3.50
2 slicks	1.50	3.00
4 clamping bars	2.00	8.00
2 carrying hooks	2.25	4.50
2 pike poles 10 feet long	1.70	3.40
2 pike poles 12 feet long	2.04	4.08
4 pair Klein pole climbers, complete, with straps	3.50	14.00
6 pair Klein 8-inch side-cutting pliers	2.30	13.80
6 heavy screw drivers, 6-inch bit	.80	4.80
4 No. 132-133 Klein splicing clamps	2.75	11.00
1 monkey wrench	1.50	1.50
2 lag wrenches	2.00	4.00
2 blow torches	4.00	8.00
2 take-up reels	10.00	20.00
2 pay-out reels	10.00	20.00
4 No. 4 Buffalo grips	3.75	15.00
50 feet ⅜-inch sash cord	.02	1.00
1 50-foot tape measure	1.00	1.00
1 large block and tackle	5.00	5.00
Total for each squad of 6 men	....	$178.98
Total for 4 squads	....	715.92

GENERAL CLASS MATERIAL

22 25-foot 6-inch top cedar poles	$ 6.00	$132.00
25 10-pin cross arms, with pins	1.35	33.75
50 wooden brackets	1.75	.88
60 40-penny galvanized wire nails	.08	.24
60 20-penny galvanized-wire nails	.08	.48
250 No. 9 pony glass insulators	4.92	12.30
25 ⅝x10-inch galvanized-iron machine bolts	.12	3.00
50 galvanized round washers, 1¼-inch hole	.006	.30
50 ⅜x3½ galvanized-iron carriage bolts	.02¼	1.25
50 galvanized washers, square	.02¼	1.13
11 ½-mile coils, No. 14 BB iron wire	9.00	44.00
3 ½-mile coils, No. 12 BB iron wire	9.00	34.65
6 Mathews 6-inch guy anchors	2.00	12.00
25 ⅜x4-inch gauge lag screws	4.00	1.00
4 galvanized-iron cross-arm back braces	15.00	.60
10 2-bolt guy clamps	.15	1.50
10 3-bolt guy clamps	.20	2.00
2,000 feet ⅜-inch Siemens-Martin gauge strand	3.50	70.00
1,500 feet No. 17 twist pair, copper-clad wire	15.00	22.50
15 magnet bridging telephone	....	....

1 wall type switchboard telephone	....	....
50 double groove knobs	7.00	3.50
50 3-inch No. 16 gauge iron wood screws	2.00	1.00
1 box soldering flux	.15	.15
2 pounds wire solder	.35	.70
50 sleeves for splicing No. 14 iron wire	1.75	.88
25 sleeves for splicing No. 12 iron wire	1.50	.38
6 6-foot galvanized-iron ground rods	.45	3.10
1,500 feet 25-pair lead-covered cable	....	....
1,200-cable rings	9.00	10.80
30 thimbles for ¾-inch strand	4.60	1.38
15 guy hooks	.12	1.80
12 ⅝x10-inch galvanized-iron machine bolts	12.00	1.44
25 2½-inch square galvanized washers, ¹¹⁄₁₆-inch hole	2.25	.57
12 cable suspension clamps	.12	1.44
2 25-pair cable terminals	....	....
15 lightning arresters for telephones	....	....
50 No. 18 bridle rings, galvanized	3.00	....
	....	$400.52

1 shed should be built which would permit tools and materials to be stored. This shed could be made to do for four squads, and each squad could keep its tools and material separate.

Total general material	$ 400.52
Total for four squads	715.92
Total for class	1,116.44

UNIT E-6—REPAIR AND ADJUSTMENT OF MAGNETO TELEPHONE APPARATUS

The outline for this course is based on the assumption that one instructor will be available for each 15 men to be trained, that instruction will be given daily and will extend over a period of one month, and that sufficient apparatus and material will be available for each man to work independently in performing the laboratory exercises.

DAILY SCHEDULE.

8:00 to 10:30, study period.
10:30 to 12:00, recitation period.
1:00 to 5:00, laboratory work.

Lesson 1.—A study of ringing generators for magneto telephones.

Lesson 2.—A study of the ringing equipment for magneto telephones.

Lesson 3.—A study of transmitters, receivers, induction coils and batteries for magneto telephones.

Lesson 4.—Assembling and wiring magneto telephones.

Lessons 5 and 6.—Repairing and adjusting parts of magneto telephones.

Lesson 7.—A study of the signaling equipment of a magneto switchboard.

Lesson 8.—A study of the switching equipment of the magneto switchboard.

Lesson 9.—Magneto switchboard cabling.

Lesson 10.—Auxiliary equipment for a magneto switchboard; distributing frame; power generator; protective devices.

Lesson 11.—A study of magneto switchboard circuits.

Lesson 12.—Switchboard installation.

Lessons 13 and 14.—Testing, repairing, and adjusting magneto switchboard parts.

Lessons 15 and 16.—Testing telephone lines for faults from the central office.

Lesson 17.—Review.

Lesson 18.—Dismantling apparatus.

The remainder of the time is to be devoted to review of important topics and final examination.

TOOLS AND MATERIALS NECESSARY FOR UNIT E-6

This list of tools and material is required for each group of 15 men:

15 pairs 6-inch side cutting pliers, $1.75 each	$ 26.25
15 pairs 5-inch diagonal pliers, $1.50 each	22.50
15 pairs 5-inch long nose pliers, $1.15 each	17.25
15 pairs 4-inch cabinet screw drivers, 40 cents each	6.00
15 magneto telephone bridging. (Need not be new nor alike.)	
7 magneto switchboards with operators sets. (Need not be fully equipped with line drops and jacks. These need not be new nor alike.)	
7 main distributing frames for magneto switchboard.	
200 feet, 50 pairs switchboard cable	50.00
7 testing cabinets with voltmeter and whetstone bridge.	
50 dry cells, at 30 cents each	15.00
1,000 feet No. 19 inside twist pr. $14 M	14.00
1 Yankee hand drill with set of bits, $2.50	2.50
2 hand vises, $3 each	6.00
1 gross 1¼-inch wood screws, at 35 cents gross	.35
6 electric soldering irons, $5 each	30.00
5 pounds rosin core solder, 70 cents pound	3.50
	$193.35

UNIT E-7.—CABLE SPLICING

In this course it is assumed that 1 instructor will be available for each 15 men to be trained, that instruction will be given six days a week for two weeks, and that sufficient equipment and material is available so that each man may work independently.

SCHEDULE.

First day,	8 to 12.	General lecture on telephone cable, including construction, necessary precautions in handling, etc.
	1 to 5.	Instructor makes a complete splice in which he demonstrates the use of all tools, etc., but omitting emphasis on the details of the fundamental operations.
Second day,	8 to 12.	Removing sheath and boiling out core of cable.
Third day,	8 to 12.	Testing out and connecting the pairs which are to be joined together.
Fourth day,	8 to 12.	Final boiling out, taping up splice and preparing lead sleeve for wiping joint.
Fifth day,	8 to 12.	Wiping joint and completing splice.

The fundamental processes which are demonstrated during the mornings of the second, third, fourth and fifth days are to be repeated a number of times if necessary in order that the details of operation and their execution will be clear to each man.

During the afternoons of the second, third, fourth and fifth days, each man will attempt to reproduce, under the supervision of the instructor, the fundamental process which was demonstrated by the instructor during the mornings of those respective days.

For the remainder of the first two weeks, in which there are seven full days of instruction, each man is to devote both morning and afternoon sessions to independent work in splicing. This, of course, is to be under the supervision of the instructor who will give each man as much personal attention as time will permit. After sufficient skill has been acquired in ordinary joint wiping, some special work may be given in repairing bullet holes in a cable and making potheads. Some instruction in line work is very desirable. The following questions suggest topics for study and practice:

1. Explain step by step the process of splicing and wiping the lead joints on a telephone cable.
2. To what distance should the lead sheath be removed on each end, and how is this accomplished.
3. Why do you bind the cores with muslin at the ends of the sheath?
4. Why is paper cable boiled out with paraffin? Describe the operation of boiling out before the wires are joined.
5. How can you determine when the paraffin is hot enough? What is the proper temperature? What will be the result if the paraffin is too hot? Too cold?
6. When making a joint in a manhole, what precautions should be taken before lowering a pot of hot paraffin into the manhole? Why?
7. Why are paper sleeves used? If cables have red and white wires in one and red and blue in the other, how are they joined?
8. Why is the splice wrapped in muslin?
9. Describe how the wrapped splice is boiled out.
10. How long should the lead sleeve be?
11. How long should the wiped joint be?
12. Suppose you have the splice made and wrapped, but have forgotten to slip the lead sleeve over one end of the cable, how would you put a sleeve on?
13. How do you close the seam in a split sleeve?
14. If the lead sheath of a telephone cable is broken by a bullet, would you cut all the wires and make a splice? If not, what kind of a sleeve would be used to repair such a fault? Would you take off some of the sheath and boil out the cable with paraffin?
15. Tell how to prepare the sleeve for a splice. Why are the ends scraped and tallowed?
16. What are the pasters used for? What can be used for substitutes?
17. When wiping a joint, where is most of the solder poured, and why?
18. If you burn the lead sheath, what would you do?

19. How would you inspect a wiped joint if it were in such a position that you could not see it from every angle?

20. Tell how to fill a splice with paraffin after the lead joints are wiped. Why is this done? How do you close up the holes?

21. What is the objection to leaving a cable open over night? When may this be done, and what precautions are necessary.

22. Explain step by step the process of making a pothead.

23. How can you tell when the compound it hot enough?

24. What may be used as a substitute for compound?

25. Is the paper tube described in the S. C. Manual for making potheads necessary?

26. In making a pothead, where do you put the rigid rubber wire?

27. Make a sketch and explain the construction of the ordinary telephone cable. Why are wires of different colors?

28. Make a sketch and explain the construction of lead covered twin power cable. What is the purpose of the lead sheath?

29. Which is the better system of distribution, overhead or underground?

30. About what is the standard distance between poles?

31. Show by sketch how to turn a right-angle corner on a single pole. Show guy wires.

32. In running wires through trees, should they be allowed to touch any part of the trees?

33. (*a*) For what purpose are manholes used in conduit work? (*b*) How far apart are they usually placed? (*c*) Where are they preferably placed?

34. How is the cable supported in manholes?

35. What is a good formula for a concrete mixture for conduit work?

36. What are the different kinds of conduit used for? How is vitrified clay conduit kept in line when being laid?

37. What is meant by rodding? Describe the operation of drawing in cable in an underground conduit system.

TOOLS AND EQUIPMENT NECESSARY FOR EACH MAN

	Each	*Total.*
1 stripping knife	$ 1.50	$ 1.50
1 box wood dresser	....	....
1 lead scraper	1.50	1.50
1 small mirror	.10	.10
1 pair electrician's scissors	1.75	1.75
1 sheet-iron pan 16x36x3 inches deep	....	....
1 tool bag	4.50	4.50
2 dry cells	.35	.70
2 gallons gasoline	.25	.50
5 pounds wiping metal	.50	2.50
5 bars half-and-half solder	.45	2.25
1 pound friction tape	.35	.35
500 paper sleeves	....	....
10 feet white paper 3 inches wide	....	....
2 pounds paraffine	.15	.30
5 lead sleeves for splicing 50 pair cable	1.30	6.50
4 rolls muslin 3x10 inches	.75	3.00
		$ 25.45
Tools and equipment necessary for each 2 men—		
1 plumber's gasoline furnace	....	$ 6.00
1 6-inch solder pot	....	1.50
1 1-gallon enameled coffee pot	....	1.00
1 3-inch ladle	....	1.00
1 blow torch	....	3.50
1 head receiver	....	2.50
1 operator's transmitter	....	3.50
20 feet 50 pair lead cable	....	5.00
		$ 24.00
Individual equipment for 15 men		$381.75
Group equipment for 15 men		168.00
Total		$549.75

Signal Corps Has Openings

The Signal Corps, U. S. Army, has announced that it can use the services of a large number of men having electrical training. They are needed especially in connection with the radio communication systems in use in the military service. All classes of electrical men—wiremen, expert electricians, storage battery men, telegraph and wireless operators, and men with electrical engineering training and experience are wanted. The opportunity offered is exceptional because of the great interest and importance of this branch of the service, which has been most aptly characterized as the nerve system of the army. Men engaged in the radio division of the communication work in particular have an increasingly important part in the great intelligence system upon which army operations are almost totally dependent. The scope of this work requires men who will fall in general into three classes, depending on the character and amount of experience had by the individual, namely, radio operators, radio mechanics, and field radio experts.

Application blanks for service in the radio work of the Signal Corps may be secured by addressing the Office of the Chief Signal Officer, Land Division, Training Section, Washington, D. C. Men of draft age may make application, and if qualified will be inducted into the army, at their request, for service in this branch of the Signal Corps. After enlistment or induction, all personnel will be sent to one of several radio schools for six weeks to three months of intensive training in the one of the three general branches of the radio work for which their previous experience qualifies them. Some of the personnel completing these courses will be commissioned, and the opportunity for advancement for all graduates will be dependent on the individual ability.

Ordnance Department Wants Men

Men having a high school education, some shop training and the natural ability to adapt themselves to new work, may qualify for a government appointment in which, under government instructors, they will receive the necessary training for the positions described below. Those who have the required technical training will be placed and advanced as quickly as their ability justifies.

Inspectors and Assistant Inspectors, Field Artillery Ammunition Steel.

Inspectors, Artillery Ammunition, Cartridge Cases, Assembling, Loading, Forging, Primers, Detonators, Shell and Shrapnel Machining.

Ballistic Inspectors.

Metallurgical Chemists and Assistants.

Inspectors, Powder and Explosives.

Inspectors, Cannon, Forging Operations.

Inspectors, Gun Carriages and Parts.

Inspectors, Gun Fire Control Instruments.

Asst. Inspectors, Motor Vehicles and Artillery Wheels.

Engineers and Assistant Engineers, for tests of Ordnance Materials.

Inspectors, Ammunition Packing Boxes.

Machinists, accustomed to work to one-thousandths of inch.

These positions are under civil service regulations, but applicants will not be required to report for examination at any place. Applicant will be rated in accordance with education and general experience. No applications will be accepted from persons already in the government service unless accompanied by the written assent of the head of the concern by which the applicant is employed. Papers will be rated promptly and certification made with least possible delay. Apply or write for further information to C. V. Meserole, Special Representative of the Ordnance Department, U. S. Army, Room 800, 79 Wall street, New York City.

Your Bond Buys Explosives

Many telephone men here in America have used giant powder or dynamite in blasting for pole holes and the like. Explosives are dangerous to handle and we all duck our heads and run when the charge is to be set off. Over in France today our sons are having the stuff hurled at them every minute of the day and night, with an occasional volley of gas shells that choke and strangle to death, and they don't dare run. With the boys looking death in the face over there, we can do no more than look the issue squarely in the face here at home and buy Liberty bonds and see that they are provided with ammunition to return the kaiser just as good as he is sending across to our trenches.

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

BY FRED W. SHOLZ

The Present Status of Pole Preservation:—The treatment of poles for telephone and telegraph use has now been in existence a good many years, and has reached a point where we can say that practical results have been achieved and that the industry has partly reached the goal that it set for itself, when first started. A summary of the chemical means taken to preserve the poles and the relative merits of the different preservatives may therefore not be out of place in this paper.

Probably the most important of the wood preservation means is the sublimate, as well as a large number of other types of salts, as for example, the sulphates of copper, iron and aluminum, the chlorides of zinc and of sodium, and within recent years also the alkaline salts of the fluoric acids. Aside from these inorganic salts, we also find a number of organic salts used, although their use has become prominent only within recent years. The alkaline salts of the phenoles, the cresoles and their substitutes have been used for wood preservation. A further group that must also be mentioned embraces the acetates (acetic salts), the salt mixtures and the double impregnation with salts that give precipitates.

In general a satisfactory wood preservation treatment is closely allied to the following points: The salts used for preservation must have a conservation effect which is beyond question. But the mistake must not be made to argue because a salt has a preservative and antiseptic effect for some other substances, that it is also suitable for wood preservation, and that it can protect the poles against rotting. As a matter of fact the fungi and organisms that attack the poles in their vital parts differ greatly from other micro-organisms, that attack living species of other kinds of material. If troublesome and expensive trials are to be avoided, a preservative salt must be first tested as to the effect it will have by making tests identical with the practical conditions which the preservative will have to meet later on. This is usually done in bacteriological cellars of laboratories, where species of timber, impregnated with the salts to be tested, are exposed to dampness and attacks of fungi of the types met in the open air under service conditions. Often these bacteria and fungi are especially raised through bacteriological cultures and then their effect on the preservative is tested in great detail.

But, after all, these are only laboratory attempts and the real test comes only when the preservative is used in actual practice, and this takes years of observation. The action is exclusively a physiological one, since the salts react on the fungi cells in shape of a poison, killing the fungi. But such an effect can only take place, if the salts are taken up and assimilated by the fungi. Consequently, insoluble salts, such as the petrifying carbonates and sulphates (gypsum, marble) have no effect. Of the soluble salts, all of them probably have an injurious effect on the fungi, when used in sufficient concentration. But the limits of this necessary concentration are quite different for the various salts. While in the case of corrosive sublimate, a concentration of 1:1000, kills most of the fungi, ordinary salt is resisted by the fungi in concentrations as powerful as 1:10. Provided a salt is sufficiently cheap, one might hold the idea that the matter could be balanced by using a powerful concentration and thus equate the weaker solution which could be used with a much more expensive preservative. But while this may be perfectly true from the viewpoint of money expense, it is not so true from the viewpoint of the timber to be preserved. If we take the sublimate as an example of an efficient and powerful preservative, we find that we need about 1 kg. (2.2 lb.) sublimate for every cbm. (35 cu. ft.) timber, in order to obtain sufficient protection. But to obtain the same protection, we would have to force at least 100 kg. (220 lb.) salt (NaCl) into the timber. But salts can be formed into the timber fibres only in a state of solution. The nearer the salt comes to the saturation point, the worse will be the power of penetration into the fibres. A salt solution of the ratio 1:3 is already saturated, however. As soon as such a solution enters the outer wood fibres, its water is withdrawn by the cell membrances, the salt precipitates, of course, offering tremendous resistance to the entrance of further quantities of the preservative. If we use a more dilute solution, it is not possible to force more than a definite quantity of the preservative into the cells of the timber. Pine, for example, cannot take more than 250 liters solution per 35 cu. ft. wood under normal conditions. At that concentration, however, the preservative effect of the salt is practically nil, and there is as good as no protection. If the practical limit of concentration at which the preservative can be forced into the timber lies near 15 per cent, this would mean a maximum quantity of 40-50 kg. (88-110 lb.) of the salt to be forced into the timber. In reality this amount cannot be reached, as it remains near 66 lb. It is obvious from these remarks that the use of less effective salts is very limited, and comes into question only where such salts are extremely cheap, or where better preservatives are absolutely unobtainable. Such a state exists in the case of the Russian railroads near the Caspian Sea, where sea salt is used as preservative for railroad ties and telegraph poles, since the salt is obtained practically for nothing and where other preservatives are difficult to obtain owing to the distance and to poor freight conditions.

Aside from the antiseptic power of the salts, tests must be made to see whether these do not attack the wood itself. A number of preservative salts liberate in aquaeous solutions, especially when exposed to higher temperatures, free mineral acids, which in turn bring about a decomposition of the wood fibre. But such attacks can deteriorate the resistance and strength of the pole to such an extent that the success obtained from impregnation becomes illusory. The most powerful effect in this regard has been observed when using iron vitriol (hydrous ferrous sulphate) and in a less pronounced manner in copper vitriol (blue vitriol or copper sulphate) and zinc chloride. This effect seems to have a certain relation to the concentration at which it is used; when used within the usual limits of 22 lb. per 35 cu. ft. of timber the effects seem to be moderate. But since the preservative effect at this concentration is far behind that obtained with 1 kg. (2.2 lb.) of sublimate, it is clear that no balancing effect can be obtained, if greater concentrations are used, for then the destructive effect on the strength of the pole becomes prohibitive.

Another point to be observed is that the salts, when once brought into the wood, cannot be washed out by the moisture in the wood and the exposure to the rains and wet storms of the season. Even after years of exposure to such conditions, there must still be enough preservative salt adhering to the timber fibres to protect them against the attacks of fungi.

A rational impregnation process also requires that practically all of the wood fibres are filled with the preservative liquid. The pneumatic impregnation methods now used fulfill this condition admirably. But if the impregnation process is satisfied with a rapid immersion of the poles in the impregnation liquid, it may happen that only the outer layers of the wood are impregnated, while the inner sections are not affected. The result is, that while the outside of the pole looks perfectly healthy, the inner core is decaying and the life of the pole is only very limited.

If a salt is of sufficient strength, the poles can be treated by immersing them in the liquid and leaving them there for a considerable time. The Kyan process is one that makes use of this method, in that sublimate is used. When weaker salts such as copper sulphate are employed, the long duration immersion method has always failed.

If we keep in mind all of the points that have to be considered in choosing an impregnation liquid, it will not be surprising if the number of processes that are really efficient is extremely small when compared with the large number of patents that have collected since wood impregnation first became an industry. Many of the salts and preservatives are fitted for one process, but not for another.

For example, copper sulphate can be used with fair success in the long time immersion process and in the Boucherie process, but fails when applied in the pneumatic process. In this latter, the aqueous solution comes in contact with the iron walls of the pneumatic troughs; the salt soon is decomposed and metallic copper is precipitated. The free acid, on the other hand, now attacks the iron vats and other metal parts and destroys them. The use of copper vats is out of the question owing to the high expense.

Further, the salts must be of a stable nature, i. e., they must not change within the cellular fibres into less effective substances. For example, when using copper sulphate, it has been observed in certain localities that the sulphate has been transformed through the effect of certain salts in the soil into other substances, which were quite harmless to the fungi.

Within very recent years another copper compound, the cupric oxide ammonia, has been recommended for wood preservation and has been introduced in European markets under the trade name "Aczol." Aside from the fact that this compound is very high in price, it has another even greater disadvantage. It is well known that cupric oxide ammonia is a solvent for cellulose, attacks the wood fibres therefore, and decreases the strength of the poles. In addition the protective effect is not very high and is hardly higher than that of the copper sulphate.

Zinc chloride which has also been used extensively for preservation is a little better in its protective effect than the copper salt. It is much cheaper than the latter and can therefore be used in greater concentrations. Moreover, the pneumatic progress of impregnation can be used with this salt. But its disadvantage lies in the fact that it liberates free hydrochloric acid, which can attack the wood and any iron parts that are in the pole, like iron bolts, screws, etc.

A great advance in the preservation industry was the introduction of the fluorine salts. The alkaline salts of hydrofluoric acid especially are of great use owing to their strong antiseptic effect. Even though dissociation may occur when using these salts in aqueous solutions, the hydrofluoric acid does not attack the cellular fibre to such a great extent as do the acids liberated by the zinc salts. All of these preservatives protect the wood against the attacks of fungi and the addition of such materials as rosins, oils, etc., merely help in fixing the preservatives closer to the wood fibres.

Entirely different viewpoints are taken by other impregnation engineers who advise mixtures of different salts. The purpose of these later processes is to bring greater quantities of salt within the fibre. It was proved that this results in a slighter inflammability of the wood and this is of advantage to railroads and mines, though not so much to the telephone industry. To obtain this effect, the really preservative salts are mixed with salts that give a certain fireproofing effect to the wood. This process is carried out in two ways: Either the wood is treated in successive stages with the different preservatives, or else the salts are first mixed in their solid form with each other and are then brought into aqueous solution before being applied to the timber. The selection of the consecutive salt preservatives is usually chosen so that the second salt solution forms an insoluble precipitate with the first salt solution, and these, forming within the wood, protect the latter. But when introducing the second salt solution, such precipitates form on the surface of th ewood. These clog the pores of the wood and prevent the further penetration of the second impregnation liquid. The insoluble salts are the ones, however, that really have the most powerful effect.

Various engineers have made extensive experiments in these lines. They argued correctly that proper impregnation can be obtained only when using a vacuum, high temperature and pressure. But certain of the processes advised a boiling of the timber within the liquid for 2 to 4 hours at a temperature ranging between 135° and 140° C. But at these temperatures the wood is decomposed to a great extent and subsequently the temperatures were reduced to 100°-115° C. and the pressure was set at 2 to 2.5 atmospheres.

Quite an advance in impregnation processes was the introduction of fluorine salts. These salts have excellent preservative effects, the liberated hydrofluoric acid attacks the wooden fibres only to a slight extent and the salts, once they have penetrated the wood, are very hard to wash out.

Very recent years have gone over to the use of organic salts for wood preservation. In that respect we can note a close following in the steps taken by medicine, where the heavy metallic salts have gradually been replaced by the metallic-organic compounds. The organic compounds of silver, mercury, copper, arsenic and selenium are used extensively for their therapeutic effects and the same is true of some of these salts when applied to timber. It was found that the poisonous effects of the metals were decreased, while the healing effects of the organic compounds on the poles were increased. The use of organic compounds of mercury, arsenic and antimony was patented by the Bayer Company in Elberfeld, but their claim that these salts have a much greater protective and fungi destroying effect than the formerly used metallic salts is very doubtful. Practical results have not shown that the laboratory results obtained with these newer substances can be transferred offhand to

use with poles in the open air. The effect of these salts is therefore still surrounded by a great deal of doubt.

Aside from metal-organic compounds, the derivatives. The poisonous of these compounds has often tion. But as there are no extensive observations on hand, made under actual outside conditions, no valid conclusions can be drawn as to the value of these preservatives. The poisonousess of these compounds has often been stressed too much. That point is of little importance, provided the preservative really attacks the fungi and protects the wood.

Very little can be said about the price of the different preservatives, as this depends on localities and other conditions. Under equal conditions, a company will choose that preservative, which can be most easily obtained at the most reasonable price, provided always that the protective effect is the same. This latter point is the one always to be watched and usually it will be more advisable to procure a more expensive, but more powerful preservative rather than the cheaper, but less effective one.

Following is a brief survey of some of the best known combinations of preservatives known in the industry:

Potassium and Sodium Salts: Both of these salts form easily soluble salts with all acids, also with hydrofluoric acid. The sulphates form double salts wih those of the lighter metals, like aluminum. The good solubility of these salts along with their low price and the tendency to remain in a stable condition in practically any proportion, is probably the reason why they have been used so extensively, though their preservative effect is lower than that of other agents. The following combinations are often used: Common cooking salt solution. Cooking salt mixed with alum. Cooking salt and saltpeter. Cooking Salt with chlorides or sulphates of tin, zinc or copper. Cooking salt with the sulphates of calcium, zinc or iron. Cooking salt with iron sulphate and alum. Cooking salt with salpeter, iron sulphate and sodium sulphide.

Potassium hydroxide and sodium hydroxide: These attack the wood fibres extensively, have a low antiseptic effect and are used mainly to dissolve other agents, as arsenic for example. Potassium or sodium hydroxide with soda, arsenic sulphide and sodium sulphide. Caustic potash with alcohol. Potassium or sodium hydroxides with arsenates. Potassium hydroxide with potassium chlorate, maganese oxide and potassium chlorate.

Sulphates and Sulfides: These are easily soluble and have very little effect. Sodium sulphide with iron sulphate, saltpeter and cooking salt. Sodium hyposulphite with copper, potassium chlorate and zinc sulphate.

Carbonates and bicarbonates: Their protective effects against decay of the fibres is very slight. Sodium bicarbonate with alum, lime and copper sulphate. Soda melted together with sodium silicate and treated with chlorine. Potassium carbonate with copper sulphate, alum, lime and sea salt.

Alums: When adding soda or potash to the common alums, we receive the basic alums, which are not easily soluble and have a protective effect against inflammability. Alum with cooking salt. Alum with sulphur. Alum with saltpeter and iron vitriol. Alum with potash, milk of lime and copper suphate. Alum with cooking salt and then ferric oxide.

Potassium—or Sodium Silicate: These are the only aqueous soluble salts of silicic acid. They draw carbon dioxide from the air and form a protective film over the timber, which protects the latter against fire. They are not suitable for impregnation as they do not enter easily into the wooden fibres, even when in a dilute condition and as their antiseptic effect is very low.

Iron Vitriol, Green itriol, Iron Sulphate: These play only a minor role in wood impregnation, though used extensively for that purpose some fifty years ago. Only one or two of the minor processes use them today. Iron sulphate with alum and cooking salt. Iron sulphate with zinc chloride. Iron sulphate with nickel sulphate and arsenic.

Mercury: The mercury salts for the most part are extremely effective. The most important is the chloride, or sublimate. It is used quite freely in wood preservation (Kyanizing). It is not easily soluble, but forms an easily soluble double salt with common cooking salt. But the addition of this as also other salts decreases the antiseptic effects. Sublimate with water glass. Sublimate with salicylc acid. Sublimate with hydrochloric acid and iron sulphate. Sublimate with zinc chloride. Sublimate with cooking salt, saltpeter, copper acetate and arsenic. Sublimate with peppermint, sodium bitungstate, calcium chloride. Sublimate with soap, alcohol, turpentine, ammonium chloride.

Zinc Salts: These have a preserving effect, though it is far behind that of the sublimates. The zinc sulpnate that was formerly used is hardly used at all now, the zinc chloride having taken its place. The latter is used extensively in Austria and America. Sodium zincate, so far not isolated in the laboratory and probably found only in solutions of the basic elements (sodium hydroxide + zinc salt) and then only in certain definite proportions, has a destructive effect on the wooden fibres owing to the excess of sodium hydroxide. Zinc sulphate with zinc chloride. Zinc sulphate with iron sulphate, gypsum and cooking salt. Zinc sulphate with sodium hyposulphite, copper sulphate and potassium chlorate. Zinc chloride with other metallic chlorides. Zinc chloride with mercuric chloride. Zinc chloride with aluminum sulphate. Zinc sulphate with alum.

Other soluble zinc salts: Sodium zincate, zinc acetate.

Insoluble zinc salts: Zinc oxide and copper sulphate. Zinc silicate (soluble in potassium hydroxide). Zinc silicate with caustic lime, copper sulphate and rhodium sulphate.

Copper salts: Antiseptically they are similar to the zinc salts. Copper sulphate with zinc oxide. Copper sulphate with copper acetate. Copper sulphate with sodium iodide or sodium bromide. Copper sulphate with potash, alum and lime water.—*Zeitschrift für Angewandte Chemie.*

Telephones for Inter-Office Use

THE problem of the telephone for use in offices, stores, factories must be solved in accordance with the importance of the exchanges involved in the various departments. There are different kinds of systems that can be used for this purpose. There is the intercommunicating system with push buttons, then the private branch switchboard, requiring the services of an operator, and finally the complete automatic system, where the place of the operator is taken by machine switching gear. Rarely or never do we find the three systems used

simultaneously in one plant, rather will we find each system separately depending on the nature of the service rendered.

The system with direct intercommunication is probably the best for plants of smaller importance, where the maximum number of telephone stations is 25. Where this number is exceeded, switchboards with operators are usually employed, while private exchanges with 100 tele-

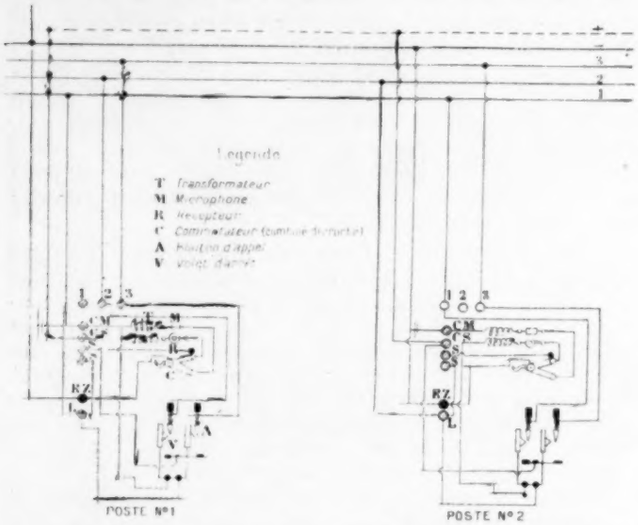


Fig. 1—Wiring Diagram for Three-Station Intercommunicating System. T—Induction coil; M—Microphone; R—Receiver; C—Switch (combined hook switch); A—Call button; V—Drop lock plate.

phones and more employ the automatic system. It should, of course, be understood that these observations do not pretend to be absolute and that each case ought to receive special consideration, in order to be given the best solution possible. The present article, however, will only discuss the intercommunicating exchange system.

The direct intercommunicating system has the characteristic that any telephone user within the system can connect himself directly with any other telephone without the use of any intermediate agent. There is then the primary advantage of needing no operator on the one hand, and secondly, the connection can be made with the other telephones by simple pressure on a button.

In this system, when worked out to its complete extent, any one station can talk to any other station it wishes and several conversations can be carried on at the same time. The wiring diagram is shown in Fig. 1. Each telephone has its own line conductor, connected to the proper terminal *L;* the negative wire of the call circuit is used as the return for the telephone circuit. Each station has terminal posts which are connected to the telephone wires of the other stations; it is clear that one of the latter is connected with line *2*, for example, it will at the same time be in communication with apparatus *2*. We will see later how a call is made and the method of carrying out the complete call operations. We know likewise, that there will have to be as many wires as there are telephone stations, plus two conductors for the call circuits. Thus for an installation with three stations, there will have to be a complete circuit with 5 conductors, and for a system with 25 stations, 27 wires are required. A supplementary wire is also necessary for the microphone battery and this battery is often placed near the station for which it supplies current.

The greatest inconvenience in this system is the increase of the number of wires with the number of telephone stations. This growth in wire material is so troublesome that this system should be used only for stations of a total number which does not exceed 30, as any trouble in the stations is too difficult to locate with a greater number of connected stations.

The old type of apparatus for this use was provided with jacks; in order to make a connection with another station, a plug was put in the jack corresponding to the station called and a total of five operations had to be carried out before finishing the call, namely: 1—plugging the jack; 2—pressing the call button; 3—removing the receiver; 4—hanging up the receiver; 5—pulling out the plug. Often the last process was forgotten with never ending trouble.

The new systems eliminate most of these actions by using the automatic push button. In this new type, the jacks are displaced by a disc with a rotating switch, worked by a small hand crank. The action is much more rapid than that with the jacks; a much greater degree of efficiency, however, was realized by the use of the automatic button which made the call and at the same time cut the telephone circuit, when the receiver was hung up again. The actions are then the following: 1—placing the switch on the part of the disc corresponding to the line to be called; 2—release of the mechanism; 3—pressing on the button, which makes the call, the button not returning completely and closing the circuit; 4—the conversation being ended, the receiver is hung up, the button returns to its original position and the circuit is cut automatically. It is not necessary here to return the rotory switch to its original dead position, as the stations are disconnected through the automatic action of the button. This was a great improvement over the older type, where the stations were connected until the plug was removed out of the jack.

Multiple Automatic System: An advance was made when each line was provided with an automatic button of its own; the switch and disc are here eliminated. When connection with any station is to be made, the proper button is pressed down, after taking off the receiver. After the button has been pressed down, the call is made, as shown in Fig. 2. The button does not

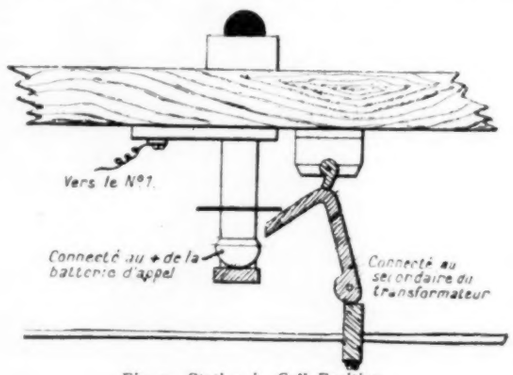


Fig. 2—Station in Call Position.

return completely to the original position and thus communication with the called line is established, as Fig. 3 shows. When the conversation is finished, the receiver is hung up again, which releases the button entirely and cuts off connection with the line in question, as Fig. 4 shows. The whole process is then reduced to three actions: 1—removing the receiver; 2—pushing on the button; 3—hanging up the receiver.

Wiring Scheme: No matter how great the number of stations may be in one complete unit, the system must have the six following terminal connections (Fig. 1):

CM—connected to the positive pole of the microphone battery.

CS—connected to the positive pole of the call battery.

S—connected to one terminal post of the bell signal.

S—connected to the other terminal post of the bell signal.

RZ—connected to the negative pole of the microphone battery and the call battery.

L—connected to the telephone line proper of the station.

The supplementary terminal posts *1, 2, 3, 4*—corresponding to the number of stations connected to the system.

Working Parts: Each apparatus contains the following working organs: 1—an induction coil *T;* 2—switching gear *C;* 3—a call and locking system *A.* The induction coil is intended to increase the capacity of the stations. These coils are generally employed even in small numbers of stations; as a matter of fact, it was found that stations with secondary circuits were far more likely to function, where stations with primary circuits were unable to work, owing to some trouble, like a poor contact, for example. Moreover, if in an installation with primary circuit, a nearby telephone is to be connected to stations some distance away, it would be necessary to transform all of the system into stations with secondary circuits, which would disorganize the entire telephone exchange system for some time and would be a much greater expense than if the entire installation had been provided with secondary circuit system from the very start.

As secondary telephone currents are of very low intensity, the induction in the neighboring wires is of much less importance, so that several conversations can be carried on at one time. Nevertheless induction is not entirely suppressed and generally conversations over other stations within the system can be followed by merely removing the receiver, not pressing down the button at all. As a matter of fact, when removing the receiver, the system is connected into circuit over the

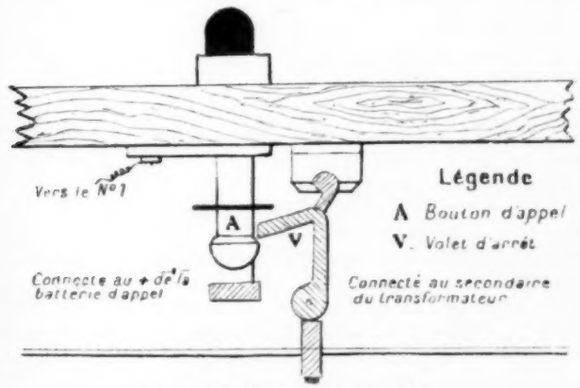


Fig. 3—Station in Talking Position.

line *L,* which runs through the whole installation. The currents induced in *L* pass through the receiver to the negative pole.

The switch gear system directs the call current coming from the battery to the bell, when the system is at rest, and to the station, when the receiver is removed.

A button, fixed in the base-board of the station, connects the line of the station called by the one using the telephone with the positive pole of the call current battery. The current goes into the switch which sends it to the bell signal system of the station in question. When pressure on the button is removed, the button comes up again and strikes against a locking plate (Fig. 3), which connects it electrically with the entire electrical circuit of the system with the aid of the induction coil. When the called station removes the receiver, the induction coil is also connected with its own telephone line and conversation can go on. As will be seen, each microphone is connected in series with a battery, but the current circulating within the telephone lines is the induction current produced by the induction coils.

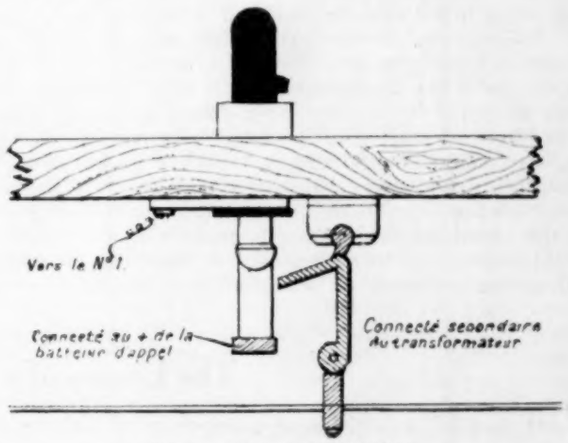


Fig. 4—Station in Rest Position.

When the conversation is ended and the two stations hang up their receivers, the switches return their respective lines to the proper position, the locking plate releases the push button and the latter returns completely to its first position ready for a new call.

Disadvantages: After having examined the advantages of this system, let us see what disadvantages there are. One of the chief faults is the fact that one has to remove the receiver before pressing down on the button. Now often, and especially at the beginning, when not quite familiar with the working method, one rings the call bell before taking off the receiver by pushing down on the button first. The button, however, in such a case returns completely to its rest position without engaging the line at all, for the locking plate *V* is pulled back as long as the receiver remains on the hook. But call current is sent through the line. The station called removes the receiver like the caller, but as no real electrical connection has been made, the conversation can be carried on only very faintly and then only through induction. To establish normal connection, the caller has to press again on his button and this time it will catch and make the circuit, since the receiver is now off the hook.

A second inconvenience is the following: Two persons are in conversation, a third one wishes to speak to one of them and presses down on his button after removing his receiver. If he places the receiver to his ear he can follow the entire conversation and could even participate in it. This point is really the worst trouble with this system. It is a great convenience to be able and follow a conversation between more than two people and have them communicate with each other, but inversely, the conversation between any two parties can be listened

to by a third person without the other two being aware of this fact. Privacy of conversation is therefore a very dubious factor, an important point in business.

Wiring: The wires are best placed in conduits or lead covered cables. One cable can have a number of wires, insulated and having different color cotton or silk insulation, so as to tell the wires to the different stations apart. The lead sheath cable has the advantage of being easily placed, taking up little room and being protected against humidity. It is always best to keep a few wires in the cable in reserve for future new stations.

Some manufacturers carry a lead sheathed cable with a special feature, which they call an anti-induction cable. In this cable the insulation of each wire is wound about with tin foil. This covering forming a sort of screen is in electrical connection with the wire connected to the negative pole. The induced currents are produced within the tin foil and are conducted directly to the negative pole. Under these conditions no induction current passes to the receivers, which avoids trouble in conversation. If this cable is properly installed it does a great deal to reduce the nuisance of induction troubles. Of course instead of these lead cables, the wires can be run under wooden mouldings and the advantage is here, of course, in the looks, as different kinds of moulding can be used, depending on the decorations in the room or office.

One of the worst and most troublesome points to settle is the approach of the wires to the different telephone stations. Having the cable hang down from the ceiling gives an unsightly effect. It is therefore necessary to run it from the floor up by cutting a trench in the floor and running the cable in that.

Storage batteries are used for current source to supply microphone and call current; in the systems with secondary circuits one battery is sufficient for the microphone, while a battery of from 6 to 8 units will suffice for call current. When all the stations are on one floor it will be found good practice to unite all the batteries in a proper closet or small partitioned space and to label each one. This will facilitate trouble finding and inspection of cells. When the stations are on different floors, the batteries can either be gathered in one place or else they can be collected by stories.—*F. Hamés, Revue Generale de l'Electricite.*

The Limits of a Telephone Receiver

THE use of the telephone receiver as a detector for very feeble alternating currents in both wireless telegraphy and wireless telephony; its use for a large number of electrical measuring processes in which the a. c. bridge is used, make it seem necessary to find a simple and accurate method to measure the power of sensitiveness of the telephone receiver. The curve representing the perception or sensitiveness of a telephone as a function of the frequency and the e. m. f. utilized, constitutes a good indicator for the field of usefulness of the instrument in question.

The usual method followed to plot such a curve consists in measuring first of all the sensitiveness of the telephone in terms of volts for the different frequencies. This is usually done by means of wire conveniently mounted in shunt over a branch which lacks the self-inductance of an alternating circuit and providing the outfit with a hot-wire ammeter. After having measured the sensitiveness in volts, the current expressing the perception limit is obtained by dividing the number of volts for each frequency by the impedance of the telephone for each frequency. As, however, the effective resistance and the inductive reactance of the telephone depend on the frequency, it is necessary in this method, to measure each of these quantities for each frequency. Moreover, it is doubtful, as Austin has already pointed out, whether the values thus obtained are really applicable to the end looked for, for they are obtained by much more intensive currents than the currents to which a telephone is sensitive. One can avoid these difficulties and simplify the determination entirely by means of the following method which is based on the Wheatstone bridge.

The wiring is shown in Fig. 5. The resistances R and R' must have neither self-inductance nor capacity. For telephones of feeble resistance, Curtis coils will meet this end very well, but for telephones with great resistance, especially with high frequencies special "film" resistances must be used. The two resistances marked R' are connected by a wire of convenient resistance provided with a scale and a sliding contact. The telephone is connected to the sliding contact and at a point chosen between the two resistanses R as indicated in Fig. 5. A small variable air condenser is also connected where it is necessary to bring about exact balancing between the reactances. The letters ΔR_B will designate the resistance of this portion of the wire with its gliding contact, comprised between the central point and the position occupied by the contact, when the telephone is energized by the current equal to the limit of sensitiveness I_T.

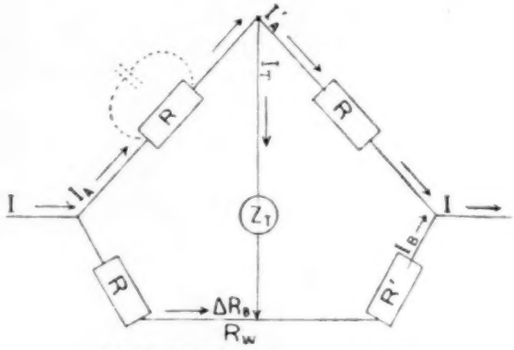


Fig. 5—Wiring for Telephone Testing.

The current I comes from a generator with high frequency, whose frequency can be regulated and kept at definite limits. It enters the bridge at the right and branches off as the figure shows. A thermo-electric couple is placed in series with the bridge (not shown in the figure) connected to a very sensitive millivolt-meter. This instrument measures the current I. For telephones with great resistance one can use a hot-wire ammeter.

The method consists in regulating the current I until the zero or silence interval measured by way of the sliding contact has a measurable value. This interval is evidently equal to $2\Delta R_B$ ohms. The value of I_T is deduced from the Wheatstone bridge equation: $I_T = \frac{2\Delta R_B R I}{A(A+2Z_T)}$, where A designates the expression: $R^1+\frac{1}{2}R_W+R$.

The method seems to assume the knowledge of Z_T, the impedance of the telephone, but one can evidently pass by this factor, if A is taken great enough, so that $2Z_T$ be negligible when compared to A, or else, if it is great enough, so that the ohmic resistance of the telephone, found with sufficient accuracy, can be used in place of the impedance. For telephones with low resistance, this substitution offers no great difficulties, because the impedance of a telephone with a low resistance does not pass beyond two or three times the ohmic resistance, even in high frequencies. In the case of certain telephones with great resistance, as used in wireless work, where the impedance for a frequency of 1,000 periods per second can attain 16,000 ohms, it would naturally be necessary to determine and use a value approaching the impedance.

For a telephone in electric resonance, the value of Z_T in the preceding equation is reduced to the ohmic resistance R_T.

Following is an example of determining the sensitive current limit of a telephone receiver: The high frequency generator furnishes current at 990 periods per second. Boxes with Curtis resistance coils are used to obtain the two resistances represented by R, each box worth 5,000 ohms. The expression: $R^1+\frac{1}{2}R_W$ has a value of 125 ohms. The interval of silence on the wire with sliding contact is found to be equal to 0.025 ohms ($2\Delta R_B=0.025$). The thermo-electric couples indicate a current of $I=0.4$ milliamperes. The ohmic resistance of the telephone is 170 ohms and its impedance for 1,000 periods per second is 290 ohms. For A we will then have 5,125 ohms. The value of $2Z_T$ can evidently be neglected when compared with the 5,125 ohms; or rather one can replace it by $2R_T$, or 340 ohms, since in either case the error committed will be less than 10 per 100. When substituting these values in the preceding equation one will find that the current of sensitiveness of the telephone is 2.10^{-6} milliamperes for a current of 1,000 periods per second.—*L'Industrie Electrique.*

Bell Takes Federal at Last

The New York Telephone Company at last has taken over the Federal Telephone and Telegraph Company, a $10,000,000 company, operating in Buffalo and vicinity. This became known officially March 13, when the New York Stock Exchange announced it had approved the application of the American Telephone and Telegraph Company to list $6,000,000 of additional stock.

In exchange for this new stock the New York Telephone Company will give the American Telephone and Telegraph Company $7,500,000 par value of Bell Telephone Company of Pennsylvania stock. The New York Telephone Company will then turn the stock over to a trustee to be named by the Federal Telephone and Telegraph Company. The shares will be placed in a trust agreement for two years, at the expiration of which they will be distributed to the Federal company's shareholders.

The Federal company, which is controlled by the Consolidated Telephone Company, was incorporated December 28, 1908, in New York, to provide local and long distance service over the western half of New York state. It controls through stock ownership the Rushford Telephone Company, Century Telephone Construction Company, Still Alarm Company, Caroline Telephone Company, Caroline Telephone Company, and Rochester Telephone Company. In 191 it acquired the Geneva Telepany, and Rochester Telephone Company. In 1916 it acquired the Geneva Telephone Company and the Plattsburg Overland Telephone Company. It has between 18,000 and 19,000 subscribers. Its properties in Buffalo and western New York are valued at more than $7,000,000. A year ago last November the merger was ratified at a referendum.

Offers Line to Government

A controversy between the California railroad commission and the Bigelow Telephone Company resulted in the offer of the Bigelow contingent to give to the government the entire plant of the Huntington Lake telephone line, provided the present subscribers to the line shall have continued service under existing contracts with the present management. The offer was taken under advisement.

The Bigelow company constructed an independent line for the purpose of operating a stage dispatchers' department over the mountain roads, and for use of the few lodges in the mountains. The line has not been a success from a financial point of view, and was about to be abandoned when the appeal was taken by rangers and subscribers for an enforced action to maintain the service. Complaint was made also that the line had too many free patrons, the majority being among employes of the government, and more especially by rangers and others, who kept up weather signals and general observations, while the power company operating in the mountains had also used the line. Should the government accept the offer of the Bigelow company, the line will be reconstructed and extended to include new territory. At present the stage company is not using the line, except for emergency needs.

Florida Association Meeting

The eleventh annual meeting of the Florida Telephone Association was held in the auditorium of the chamber of commerce at Jacksonville, March 6. Forty-three cities and towns were represented at the meeting. The address of welcome was delivered by F. C. Groover, president of the chamber of commerce. R. W. Storrs of DeFuniak Springs responded on behalf of the visitors. This was followed by the annual address of the president, W. G. Brorein of Tampa.

Following the reports of the various committees the convention took up the discussion of How Telephone Employes Can Best Serve the Government, and The Necessity of Increasing the Rates in the Smaller Exchanges in Order That Proper Service May Be Maintained.

During the discussion of the first subject it was brought out that the government had used the telephone systems of the country to good advantage during the present war. Orders have been sent to all parts of the country within a few hours.

Just before the meeting adjourned officers were elected for the ensuing year. The old officers were elected as follows: President, W. G. Brorein of Tampa; vice-president, Dr. W. L. Moor of Tallahassee, and secretary-treasurer, C. A. Prim of DeFuniak Springs.

Gas Masks for Manholes

Gas masks, the same kind as are being used "over there," can be seen in use here. Employes of the Central Union Telephone Company working on an underground cable at Terre Haute, Ind., are wearing the regulation military gas mask, Manager F. H. Kissling said.

Recently, while work was being carried on at the point, the men did not use masks and one of them was overcome. Since the gas masks have been put in use no further trouble has been experienced.

Telephone Courtesy Pays

That women are less courteous and less patient when using the telephone than men are is something that any telephone operator will tell you, if you ask. And if the telephone operator is inclined to expand on this truism, and you are inclined to listen to the expansion, she will go on to say that business women are still more courteous than women of leisure.

She will continue, it is usually the woman "with nothing to do and all day to do it in who raises a row if she has to waste one minue while the operator makes her connection. And that's probably because," the operator will tell you, "just because she has never had anything to do and hasn't enough imagination to know that the 'hello girl's' job has its difficulties just like any other sort of business."

True, the woman of business usually has imagination enough to make allowances for hitches and halts in the telephone service, but the woman of breeding, whether she be of the leisure or the industrious class, takes time to be polite over the wire. Of course, there always will be women who, just because they are not seen, forget to mind their manners when talking through the telephone. For them it might be well if a visual impression went with the sound of the voice, so that with the words of the speaker we could catch a glimpse of the face as well.

When telephones were a novelty there was some excuse for a display of confusion and at times irritation when talking over the wire Some women, several years ago, used even to refuse to use the 'phone at all, so uncertain were they of the mode of procedure, but now one might as well refuse to talk over the 'phone as to refuse to ride in an automobile.

And with the acceptance of the telephone as part of the social and business life around us we have had to formulate certain definite rules of procedure—hello-hello etiquette, if you will.

Telephone companies have come to the conclusion that politeness pays. There was an effort to save time, not long ago, by eliminating please, but before the experiment had gone far, it was found that the time saved was not worth the good spirit that was lost. So now it is part of every hello girl's duty to add the magic word of politeness. Surely, the woman who uses the 'phone socially or in her business duties can be as polite as the operator. So when you call your number to central or your own local operator say please. It's a good sendoff.

If you can't get the number, if you feel that you have waited an unnecessarily long time, and you want to express your impatience, tell the operator you wish to speak with the chief operator, and even when you make this request, remember the please. You know there is a rule that no regular operator may enter into a discussion about hitches on the line. She is forced by strict rule to confine herself to certain phrases.

If you begin to argue all she can do is to refer you to the chief operator or to the manager. What a very mean advantage you are taking when you choose to argue with or give vent to your anger to some one who can't "sass back"! It's like wanting to run a race with a man who has no legs.

When you give your complaint to the one whose business it is to receive some hundred such complaints every few hours, do it briefly. For your own sake restrain your eloquence. The ears that are listening have grown accustomed to even more brilliant rhetoric than yours. And you merely irritate yourself by showing much vexation. Of course, if the error is a serious one, you should make the complaint. If it is very serious, you may even make a written report to the manager. But the chances are that by the time you have thought it over you will have decided that it isn't worth while.

Once a connection is made nine women out of ten start off thus: "Hello, who is this?" or "Hello, is this Broadway 100?" and, when the local operator says it is, "Give me Miss Brown," and then, when Miss Brown's voice is heard, "Oh, hello, Annabel! How are you? I've had a perfectly awful time getting you," etc., etc. And never once does this kind of telephone bungler take time to mention her own name.

Bear this one thing in mind: Never ask a person over the wire, "Who is this?" It is not a bit of your business whom you are talking to, and no one need tell you without first knowing who you are. When you get your number, before asking for the person with whom you wish to speak, announce yourself. Say: "Hello, this is Mrs. Smith talking. May I speak to Miss Brown?" Or, "Hello, Miss Brown," if you recognize her voice, "this is Mary Smith."

Many business persons and some society women as well refuse to answer a telephone call when the person who wishes to speak does not announce himself first. A caller would be as well justified in thinking that she would be ushered into a drawing room when she was unwilling to give her own name or a card.

An Improved Transmitter

A recent British patent deals with telephone transmitters and has for its object the elimination of the risk of damage to the parts when being assembled together, and a further object of providing a case that will be practically water-tight and damp-proof, and not liable to damage in ordinary usage. Instead of using simply a carbon diaphragm, a carbon plate or electrode is employed in combination with a protective metallic or ferrotype diaphragm, the two forming what may be termed a compound diaphragm. The protective diaphragm fits like a lid over the mouth of the container, and is secured water-tight thereto. The jointing may be effected either by providing the diaphragm integrally with the turned-up cylindrical flange, which is bent over a corresponding flange or edge on the case, or by means of a separate flanged ring, which may be bent over the edges of the diphragm and the case, so as to grip them tightly between its flanges, the surfaces being previously covered with white lead if desired. In addition the non-vibrating electrode, having grooves for the pellets or granular material, is secured to the case by a water-tight fixing.

Passport by Telephone

Desirous of sailing on the Toyo Kisen Kaisha liner Tenyo Maru for the Orient, C. A. Blank of the Hale Importing Company, at San Francisco, called up the State Department at Washington on long distance telephone and received permission to depart without a passport, obtaining official assurance that the necessary document would be mailed to him to Japan.

Blank was able to convince the department of the urgency of his mission and thereby established a precedent in the issuance of a foreign passport.

Public Utility Commission News

Reports Concerning the Activities of State Regulating Bodies in the Telephone Field

Alabama

THE Southern Bell Telephone Company, with the approval of Public Service Commission, will at once start installing a new system known as the common battery central enegry system, at an approximate expenditure of $200,000, which will include new buildings in the three cities of Sheffield, Florence and Tuscumbia, with Sheffield as the central location for the exchange. It is understood that a charge of 5 cents is embraced in the agreement for talks to Florence.

Arizona

The corporation commission has issued an order granting in general the new rules and regulations applied for by the Mountain States Telephone Company recently. The new rules, governing the conduct of the business in so far as the subscriber is concerned, went into effect March 10. The commission made two exceptions and changes in the rules and regulations as asked for. The first one strikes out the proposed rule requiring subscribers, where the company sees fit, to pay in advance for more than three months. The other is an amendment to read that no base rate area, exchange area boundary, or local service area may be modified without the express permission of the corporation commission. After March 14, incidentally, the company became privileged to cut off the service of subscribers who persist in violating the rule limiting ordinary conversation to five minutes.

California

F. L. Barney has filed with the railroad commission an application for authority to build an operate a telephone line extending eight miles east and six miles south of Grenada, Siskiyou county.

District of Columbia

F. H. Bethell, president of the Chesapeake and Potomac Telephone Company, raises the question why relief should be withheld the telephone company pending the discussion of the general question of Government ownership by Congress.

His statement in part follows:

The Public Utilities Commission, upon an investigation, found that the telephone company was entitled to relief and so advised the company in a formal communication signed by its executive secretary. The relief was withheld, however, because of a representation made to the commission by the Postmaster general that if he was given authority to take over and operate the telephone system in the District of Columbia he would continue existing rates, existing wage scales, and pay the company out of the postal revenues.

There is an honest difference of opinion with respect to Government ownership, and I have no quarrel with those who believe in it. I do, however, object to the proposition that after the properly constituted authority has found that the company is entitled to relief, it must be denied that relief until the broad principle of government ownership is settled by the Congress. "Justitia Omnibus" appears on the seal of the District of Columbia. That translated means justice to all.

The telephone organization in Washington is composed of loyal, hard-working, patriotic men and women who are struggling, and struggling successfully, with the most difficult telephone situation that has ever developed. It is about time for somebody to consider them in connection with that underlying principle of Americans—a square deal.

Florida

In the matter of the application of Southern Bell Telephone & Telegraph Company to increase and change its telephone rates in Sanford, Florida, hearing is postponed from March 13, 1918, to April 17, in the city of Sanford.

Georgia

The railroad commission Wednesday passed an order which, in its opinion, will minimize the use of free telephones in places of business.

The Southern Bell Telephone Company petitioned the commission to be allowed to stop altogether the free use of telephones by the general public, and showed that it imposed a great burden which cut down the efficiency of service for regular subscribers.

The commission was not willing to go as far as the company asked, but did formulate an order which it hopes will relieve the situation materially.

"The committee is of the opinion," so reads its report, "that the demands made upon the company, its operators and facilities for services not connected with furnishing telephone service, such as inquiries for the time of day, the location of the fire and similar information, have reached proportions which seriously interfere with efficient and legitimate telephone service.

"The commission is more concerned as to this interference with good service than it is with any financial consideration to the company. The abuses to which attention has been called surely tend to overload facilities and congest traffic, especially on party lines. They materially lower the quality of service and provoke 'a train of complaints that are as varied as human irritability.'"

Of the free use of telephones kept in stores for advertising purposes, the commission says:

"The observations clearly show an extensive use of the telephone facilities of the petitioner by thousands who pay nothing toward providing those facilities, but by their unauthorized use interfere with and hinder service to bona fide subscribers who pay for the facilities furnished and who alone are entitled to their use."

The two rulings of the commission to be enforced by the company follow:

1. It is authorized to instruct its operators to decline to answer inquiries for the time of day, or like inquiries not connected with the furnishing of the telephone service. This rule should be enforced with tact and courtesy. The company is directed to carry in conspicuous type at the top of each page of its directories a notice to this effect.

2. The company is further authorized to decline to place any flat rate station in any store, office or place of business where the same is freely and easily accessible to the public, or where the purpose or effect of the location is an invitation to the general public to use the same, or where its permissible and indiscriminate free use is intended as a trade attraction. Should there be in such store, office or place of business no suitable location where the station is not accessible to the general public, or should the subscriber insist upon a location so accessible, the company shall decline to install a flat rate station, but is hereby directed to install only a metered or measured call station of its customary type with such general public use as the subscriber may permit.

Idaho

The public utilities commission is going to determine Pocatello's population. It ordered suspended a new

schedule of rates on business telephones in the Bannock county metropolis by the Mountain States Telephone and Telegraph Company. That will give the Pocatello people an opportunity to be heard. The rates charged by the telephone company are based upon the population of the town.

The public utilities commission granted the Home Telephone Company of Genesse, Latah county, permission to increase its rates.

Illinois

The state public utilities commission issued an order dismissing the petition of the Illinois Independent Telephone Association and each petitioner, representing some sixty telephone companies, for authority to increase their rates for telephone service. E. D. Glandon, of Pittsfield, is president of the association.

Authority to increase its rates for telephone service was asked in a petition filed by the Illinois Independent Telephone Company with the state public utilities commission. The company operates about sixty subsidiary concerns throughout the state, all of which are affected.

The Farmers' Fountain Telephone Company, serving clients in Monroe and St. Clair counties, filed an application with the state utilities commission for permission to increase telephone rates to $12 per year for residence telephones and $14 per year for business telephones. The present rates are $10 and $12.

The Savanna Mutual Telephone Company and the Carroll County Telephone Company have filed a joint petition with the commission asking for approval of the sale of the property of the former to the latter comany for $19,800.

The Port Byron Telephone Company filed an application with the state public utilities commission to increase its telephone rates from $15 a year for an individual business telephone and $10 for a party line to $18 a year for an individual telephone, $18 for individual residence telephone and $15 for party lines. Discount of 25 cents a month for prompt payment will be allowed.

The Cass County Telephone Company filed a petition with the state public utilities commission asking for authority to increase its rates in Chandlerville, Cass county.

The Ashland Telephone Company filed an application for an increase in rates.

The Assumption Mutual Telephone Company filed a petition with the state public utilities commission asking for authority to issue notes to the amount of $4,500.

Indiana

The public service commission will attempt to iron out differences between the Central Union Telephone Company and small independent telephone companies. The independents allege in their complaints to the commission that the Bell refuses to pay them commission on reverse-charge messages originating on the independent lines.

Because of this alleged condition some of the small companies refuse to call upon the Bell lines for their patrons when it is desired by the patrons to have the toll charges reversed. This latter condition has resulted in complaints being sent to the commission from the patrons. Because of the general unsatisfactory situation the commission will call a joint conference to straighten out the tangle.

The Central Union and the Home Telephone and Telegraph Company of Fort Wayne filed a joint petition with the commission for permission to buy and sell properties. The Bell proposes to withdraw from the Fort Wayne field, where it has a small list of subscribers, for $10,000, and the Fort Wayne Company proposes to withdraw from the Kendallville and Auburn fields for $62,500. The deal is made in the interests of better service.

In line with a finding that has been made by the public service commission of Indiana, patrons of the Waldron Company will have to pay higher for the service in the future than they are now paying, this having resulted from the filing of a petition by the owner of the company to raise the rates. The petition has been set aside, but a survey of the plant has been made and its value fixed at $15,000. On this, according to the finding of the commission, the owner is entitled to net earnings of 7 per cent, or $1,050, and to operating expenses of $4,150 annually.

The Spiceland Co-operative Telephone Company has been granted an increase in rates, effective April 1, by the public service commission. The rates as a rule will be increased 35 cents a month. The present rate of $2 a month for business telephones in Spiceland is not changed. Residence service and private lines are increased to $1.35 a month, the old rate being $1 a month. A two-party line resident service is to cost $1.20 a month under the new schedule. The town of Spiceland did not fight the increase in rates, according to the testimony before the commission and the rate for business telephones was left the same by agreement.

The telephone company was given practically what it asked for in the petition. It was shown that the company paid $21,000 for the property two and one-half years ago and that since that time the company has expended $2,200 in extensions and betterments. The value of the plant was placed at $27,500. According to the evidence before the commission the company, including the operation of the Mays plant, operated at a loss of $86.13 last year. The total receipts were listed at $7,727.96 and expenditures at $7,814.09.

An order readjusting the rates of the Winona Telephone Company was issued by the Indiana public service commission. The company asked for an increase in rates. It operates in Plymouth, Knox, Winamac, Monterey, Hamlet, Kewanna, Grass Creek and in rural territory adjacent to these places.

The commission had the property appraised, and by the order issued rates are reduced in Plymouth and increased in some other places. The Plymouth rate, which has been $2 a month, is to be $1.90 henceforth, 10 cents to be allowed for cash payment of bills. Increases were allowed on some of the rural lines.

An order of the public service commission authorizes the Northern Indiana and Southern Michigan Telephone, Telegraph and Cable Company, of Lagrange, operating in Lagrange and Steuben counties, to charge

$2.25 a month for business telephones and $1.75 for residence telephones. The value of the property was fixed at $146,837. The order requires the company to charge off 5 per cent annually for depreciation and permits it to earn 7 per cent on valuation.

The Home Telephone and Telegraph Company, of Fort Wayne, filed a petition with the public service commission to abolish its free service to the city of Fort Wayne. The commission has had a number of such cases before it recently and held that free service is discriminatory and illegal.

The Home Telephone Company, of Elkhart and Goshen, has asked the public service commission for permission to issue 3,000 shares of preferred stock of the value of $100 each, bearing 6 per cent interest. Officials of the company explained that the money is to be used in retiring bonds due in 1923 and in general improvement and extension of the service.

Representatives of the Indiana public service commission in Bristol on March 26 gave a hearing on the petition of the Bristol Telephone Company for an advance in its rates.

The Salamonia Telephone Company has asked the commission for an increase in rates on the ground that expenditures in operation and maintenance have been exceeding the receipts.

Kansas

An order requiring the Southwestern Bell Telephone Company at Wellington to discontinue the alleged discriminatory service on business-residence combination telephones at a rate less than the published schedule was made by the public utilities commission. The company was sustained in its application for authorization to file an amended schedule of rates providing for a charge of $1.50 a month per telephone for individual line residence service. The charging of the same rate to both individual and party line residence service must also be discontinued. Other rates remain the same. Rates which have been in effect in Wellington called for $1 a month for residence telephones and $2 for business telephones.

The case of the city of Medicine Lodge against the Arkansas Valley Telephone Company was dismissed by the commission. It had been charged that the telephone company was earning unreasonable returns, but the commission did not find this borne out by the evidence.

Hearing of complaints filed against the Bell Telephone Company was held by the state utilities commission. The telephone company presented a statement a part of which was as follows:

The telephone property was bought by the Bell company, April 1, 1916. At that time there were 692 subscribers and a population of 3,500. El Dorado now has some 18,000, with 1,431 telephone subscribers. As with all other lines of business, it is difficult to get men and material to enlarge the plant. Some $20,000 has been put into a temporary equipment, all of which will go to the dump when the stationary plant is finished. The new material, amounting to $125,000, is delivered and paid for and it is to the distinct advantage of the company to get action on this outlay of money. During this building and equipping the company has lost 42,000 employes by the draft and has fitted up a complete plant at Camp Funston, many of the men constructing the new plant here being taken for patriotic work. All possible speed has been made in the work, but men with expert experience are necessary to install the plant. It is now earnestly hoped that the new switchboard and other equipment will be in running order by May 1.

E. W. Grant for the public appeared, and specific cases of complaint against the company were presented. Attorney D. E. Carter and E. F. Palmer, of Topeka, presented the company's side of the case, and the finding of the commission was as follows:

That the telephone system is giving bad service.

That the telephone company is having a hard time trying to meet the situation it faces in El Dorado.

That the company should give immediate attention to the matter of lax discipline among operators, and discharge those guilty of such action as testified to at the hearing.

That Mr. Grant should immediately make report in writing of specific instances of failure to get toll service, giving Mr. Carter date, call and results and lack of results so that proper inquiry can be made and such remedial action applied that repetitions do not occur.

That the company report to the commission every 30 days as to its progress on the building; also give record of complaints made by subscribers.

That the company make every effort to realize its hopes of having the situation remedied by May 1, 1918.

Michigan

Declaring that sound discretion in the case required immediate action, Judge Wiest in the Ingham circuit court granted a temporary injunction March 1 against the Michigan State Telephone Company and the Michigan railroad commission, enjoining them from enforcing or carrying out the order of the railroad commission issued February 16, which granted to the telephone company increased rates and a metered service in the city of Detroit. The injunction will be in force until a final determination of the case by the court on its merits.

The attention of all Michigan cities is now being turned toward Lansing, where the city of Detroit's battle against high telephone rates has been opened before Judge Howard Wiest in the Ingham county circuit court.

It has become clear not only to lawyers, but to laymen, that the Detroit telephone case may have far-reaching effects on the relations between public utilities on one hand and city and state government on the other.

The main battle between the city and the company is to determine how the telephone company's property in Detroit is to be valued. The company has contended that the valuation of the property is to be based on what experts call "reproduction cost new." This means the cost of reproducing such a plant on property of equal value.

From the beginning the Detroit lawyers have centered all their attacks in an effort to batter down this theory. It has outgrown more than a mere debate between two kinds of theorists. If the company's method of valuation is accepted by the courts, all public utilities will hereafter find it easier to get recognition for their valuations and for their rate estimates, it is contended.

Detroit's attorneys and experts claim the proper basis of valuation for rate making purposes should be the original cost of the property, with the cost of improvements added.

The outcome of the valuation fight is of tremendous importance, it is pointed out. These valuation theories have never been decided by Michigan courts and it is maintained that upon their determination vast consequences depend.

Telephone subscribers are to continue paying their former rate for service regardless of the fact that the March bills now being sent out by the Michigan State Telephone Company are based upon the increased rates granted by the state railroad commission. This was an-

nounced following a conference between Corporation Counsel Duffield and officials of the telephone company. The old rates are to be continued until the court rules on the city's contest of the commission's decision. If this decision is favorable to the telephone company, subscribers will have to pay the difference between old and new rates from March 1.

Minnesota

The application of the Howard Lake Telephone Company for authority to increase its local and rural telephone rates at Howard Lake, Minnesota, was heard at Howard Lake, August 17, 1917. The petitioner desires authority to increase its rates as follows:

Individual line business, from $1.75 per month gross to $1.75 per month net.

Individual line residence from $1.00 per month gross to $1.00 per month net.

Multi-party rural, from $1.25 per month gross to $1.25 per month net.

A discount of 25 cents per month is allowed from the present rate for prompt payment.

The proposed schedule makes the present gross rate the net rate, resulting in an increase in the rate of 25 cents per month for each class of service.

The Howard Lake Telephone Company was organized December 27, 1902, and operates a local telephone exchange at Howard Lake, Minnesota, with rural lines in the vicinity, serving a total of 275 subscribers, of which 34 are business, 103 residence, and 138 rural. The local and rural lines are full metallic and all town subscribers receive individual line service. Service is now being furnished from 7:00 a. m. to 10:00 p. m. daily; there is a considerable demand by a large proportion of its local and rural subscribers for a continuous 24-hour service.

The development in the number of stations is retarded because continuous service is not furnished, and the present rate does not permit the company to furnish continuous service and allow for a fair return to the stockholders or a reserve for depreciation. The company now employs two operators at a cost of $52.00 per month. To furnish continuous service, at least one additional operator will be necessary at an increased expense of not less than $25.00 per month. Other additional expenses will be necessary on account of light, heat, etc.

Without considering the effect of the present abnormal operating costs, the proposed rates will not produce over and above operating revenue, taxes and depreciation, more than a fair return upon the actual investment in the property.

Upon consideration of the facts in this case the commission is of the opinion that the petitioner should furnish continuous 24-hour service, and finds that the proposed schedule of rates are fair and reasonable.

It is therefore ordered, that the Howard Lake Telephone Company be permitted to place into effect as of April 1, 1918, the following schedule of rates for telephone service at Howard Lake, Minnesota:

Individual line business, $1.75 per month net.

Individual line residence, $1.00 per month net.

Multi-party rural, $1.25 per month net.

Also that the company furnish continuous 24-hour service, including holidays and Sundays.

The petition of the Villard Telephone Company states that the citizens are demanding a continuous 24-hour service, and asks higher rates, but the evidence introduced at the hearing was not sufficient upon which to determine that such additional service is actually necessary. Operating conditions are such that the commission is of the opinion that if there is a sufficient demand on the part of the public for a continuous 24-hour service that the earnings of the company will permit of furnishing such service and still yield a fair return on the company's estimate of its plant value.

Upon consideration of the facts in the above matter, the commission is of the opinion that the application should be denied and the case dismissed. It is therefore so ordered.

The Parker's Prairie Telephone Company asks for higher rates. The commission finds that the evidence shows that the telephone company is not keeping its records according to the rules and regulations prescribed by the commission, and that the telephone company did not, and cannot, furnish actual figures as to the cost of operating and maintaining the telephone plant and service in question.

The commission, therefore, has no facts upon which to base an order other than dismissal. The telephone company should immediately install an adequate system of accounting as prescribed by the commission. Therefore, it is ordered that the application be dismissed.

The New London Central Telephone Company operates a local telephone exchange at New London, Minnesota, serving 78 subscribers, of which 23 are business and 55 are residence. There are also connected with the exchange 11 rural companies, operating 13 circuits and serving 281 rural subscribers. The present rates of the petitioner are as follows:

Individual line business (non-stockholders), $1.50 per month.
Individual line business (stockholders), $1.25 per month.
Individual line residence (non-stockholders), $1.00 per month.
Individual line residence (stockholders), 75 cents per month.

Up to the present time there has been no charge made to the connecting rural companies for local exchange service at New London, except that a charge of 5 cents has been made to the rural companies for calls originating on the lines of one rural company and terminating on the lines of another rural company.

It is ordered that the company be permitted to place into effect the following schedule of rates for telephone service at New London, Minn.:

Individual line business, $1.50 per month.
Individual line residence, $1.00 per month.
Connecting company rural (multi-party), 25 cents per station per month.

Also, that the company furnish continuous 24-hour service, including holidays and Sundays.

In the matter of the application of Charles Gomer, Schwarenberger Bros., E. M. Studer, John H. Holst et al., for establishing a flat rate for an interchange of messages between the Interstate Telegraph and Telephone Company and the Brownsdale Telephone Exchange Company, it is ordered that a hearing take place in the Commercial Club rooms at Austin, Mower county, Minnesota, on the 2nd day of April, at 1:30 p. m.

Nebraska

New telephone rates at Sutton, being an increase of $1 per month on business and 25 to 50 cents on residence telephones, have been authorized by the state railway commission upon the application of the Lincoln Telephone and Telegraph Company. It was represented that a large majority of the subscribers at Sutton had consented in writing to the raise, in view of the fact that the exchange has been virtually reconstructed and changed from the old magneto system to common battery service.

Business telephones will hereafter be charged for at $2.50 per month, while single line residence instruments will cost $1.50 and two-party telephones $1.25.

The company estimated the cost of reconstruction at $20,780, as against an original investment of $15,000 in the old plant. The revenues under the new rates are figured at $10,117 per year, while operation, maintenance and depreciation allowances are computed at $9,348, leaving a margin of $796.

No definite showing was made as to the property valuation of the plant, and the commission does not attempt to fix one at this time. It orders that none of the surplus earnings be paid out as dividends until such a showing has been submitted and findings made thereon.

The effort to get the Hamilton County Independent Telephone Company and the Lincoln Telephone and Telegraph Company together with respect to a united service at Hampton, Hamilton county, has ended in failure by the state railway commission. After a lengthy conference, the Independent company officials told Commissioner Taylor they were unable to make a proposition to either buy or sell. The difficulty in agreeing to sell was that their stockholders would not like it, and the obstacle to buying was that in order to take over the other company's exchange that no one, under its form of organization, could receive service unless a stockholder, and a

number of those now taking service from the Lincoln company out of Hampton refuse to buy stock.

It is probable that a formal complaint will be filed by the Hampton business men, who have tired of the two exchange system, asking the commission to order a consolidation. The Hamilton county exchange has less than fifty subscribers and the other 175.

The Wauneta Telephone Company asks the state railway commission for permission to increase switching rates from 25 to 40 cents a month. It is a combination of eleven farm lines. Thirteen of these run into Wauneta, and for years they had a board in common. Four years ago the commission ordered a consolidation, but two of the companies, each of which owns one-thirteenth of the board, refused to come in. This has led to considerable confusion and many disputes. Manager Pierson quit in disgust because none of the stockholders was willing to pay rates that would give service, but has consented to again take charge.

The Cambridge Telephone Association asks an increase of 25 cents from the present rates of $1 for the village and 25 cents for outside.

L. M. Thornton has asked the commission to prevent the Wyoming and Nebraska Telephone Company from abandoning its exchange at Belmont and compelling the subscribers to take through the Crawford exchange. The commission has notified the company that it cannot abandon any exchange without first securing permission from it.

New Hampshire

The last report of Chief Engineer John W. Storrs of the public service commission dealt with 65 telephone companies. There are fewer by considerable now, as a result of consolidations, the most important of these being the consolidation of companies in the northern part of the state and in Carroll county. The North Country consolidation brought together the Fairlee and Piermont and a part of the White Mountain companies, the former operating in Fairlee and Thetford, in Vermont, and in Orford and Lyme, in New Hampshire. The Piermont company operating in Haverhill and Orford and the part of the White Mountain company operating in Haverhill, with the Fairlee company, were consolidated into the Connecticut Valley Telephone Company. This consolidation, which did away with rival lines in Orford and Haverhill and resulted in an improvement generally in the service in all of the towns, was made in January, 1917.

The Carroll County Telephone Company, organized very recently, now includes the former Fairmount Telephone Company, operating in Wakefield, Ossippee, Tuftonborough and Wolfeboro; the Pine River company, operating in Mountainview; the Madison Local company, operating in Madison, Albany, Freedom and Tamworth; the Wakefield company, operating in Wakefield and Newfield, Me.; the Sandwich company, operating in Sandwich, Tamworth and Moultonboro; the North Conway and Jackson company, operating in those towns and Jackson; and that part of the New England company in Carroll county. The company is controlled by the New England.

At present there is only one large independent company in New Hampshire, that being the Citizens of Laconia, which has more than 2,000 subscribers. All of the other large companies are subsidiaries of the New England.

Chief Engineer Storrs, in his last published report, says of the telephone service:

> For the purpose of testing the service, 341 calls were made from stations all over the state; 46 of these calls being made from the city of Concord, 40 from Manchester, 30 from Nashua, 17 from Berlin, and a lesser number from the smaller cities and from the various towns of the state. The tests upon the lines of the New England Telephone and Telegraph Company, which serves all of the larger cities in the state and a large proportion of the territory of the entire southern part of the state, showed an average result as follows: Number of calls made, 213; average time taken by operators to answer, five seconds, or 96 per cent of all calls answered within 10 seconds. The tests upon all other lines averaged as follows: Number of calls made, 128; average time taken by operator to answer, eight seconds, or 87 per cent of all calls answered within 10 seconds.

New York

The New York Telephone Company has applied to the public service commission for authority to issue $25,000,000 additional capital stock to liquidate bills payable.

The annual report of the company, which includes the associated companies, shows earnings of $98,367,878, an increase of $9,540,416, but as a result of an increase of $11,645,839 in expenses net earnings decreased $2,105,423. Additions to plants during 1917 cost $36,823,174. The earnings are equivalent to $13.10 a share on the $125,000,000 capital stock, as compared with $13.81 a share earned in 1916.

To assist them to meet living costs, the 53,056 employes received $3,377,788 increase in compensation. There was an increase of 82,209 in the stations operated. The employes subscribed $1,745,000 in Liberty bonds and over 3,000 employes are in the army and navy.

Ohio

Recommendations made by T. E. Green, the commission's telephone expert, are that the Cleveland Telephone Company be allowed to put into effect immediately the rate increases it asked for January 1, and that it be order to put full measured service in operation as speedily as possible, instead of waiting until January 1, 1919, as planned.

Under the measured service plan, subscribers will pay a fixed amount for each call they make. In the case of single line business telephones the charge for each of the first 800 calls made each month will be six cents.

Green says the company now has 18,000 meters on hand for measured service, and these will be enough to equip the Main and Prospect exchanges for measured service.

The telephone service Cleveland now is getting from the company is "very bad," Green says in his report. He says the "worst condition is at the Main exchange, but conditions also are very bad at the Prospect, Rosedale, Garfield and Eddy exchanges."

No mention is made of the Marlo, Edgewater and Harvard exchanges, all of which are on the West Side.

Lack of equipment and too few operators are blamed by Green. He says the company needs 225 additional operators.

Raising rates won't give relief, Green says, until full measured service is in effect, which he believes will cut calls 40 or 50 per cent.

Thomas E. Green, telephone expert, and two assistants, representing the public utilities commission, started

survey in Canton, March 13, of the Ohio State Telephone Company situation.

Mr. Green conferred with Mayor Poorman, who acquainted him with the way affairs have been conducted for several years. State officials also are making tests of the Bell service here and will compare their findings with tests made of the Ohio State service.

The Ohio State Telephone Company seeks to increase its rates after April 1 in Canton and Toledo.

Consolidation has been effected between the Urbana Telephone Company and the Central Union Telephone Company, in Champaign county. The change calls for increased rates amounting to 50 cents per year for residence property and to $1 per year for business property.

A petition has been presented to the state public utilities commission for permission to effect the change.

The public utilities commission has been asked to allow the Central District Telephone Company, which operates in eastern and southern Ohio to sell its properties to the Chesapeake and Potomac Telephone Company of West Virginia.

Both companies joined in the application for the sale. They are branches of the Bell system. The consideration agreed upon is $2,664,940.

Oklahoma

The corporation commission made an order granting the increase in toll rates requested by the Southwestern Bell Telephone Company. The new schedule was filed more than a week before by the telephone company and no complaints were filed against the new rates.

The rates are based on a charge of 15 cents for the first fourteen miles and five cents for each seven miles thereafter. The raise was made necessary, stated the telephone company, by the increased cost of materials and the payment of higher wages to employes.

The Muskogee County Democratic Committee has adopted a resolution asking the state corporation commission to rescind or modify its recent order allowing an increase in the toll rates of the Southwestern Bell Telephone Company.

The committee took the stand that there is no justification in the increase of rates and that allowing such increase is merely a step toward a more vital and general increase in the rates.

Oregon

Telephone service is not to be discontinued for nonpayment of a monthly bill without the patron having first been given fifteen days' written notice, according to Chairman Frank J. Miller of the public service commission, who warned the Pacific Telephone and Telegraph Company that strict compliance with the orders of the commission will be enforced.

The warning came as result of testimony submitted to the commission to the effect that service had been discontinued in one instance because the bill had not been paid by the tenth of the month.

Immediate restoration of the old five-cent flat rate for telephone service between Portland and Milwaukie and Oak Grove, and for no extra charge for service from these two suburbs to Portland, was demanded of the Pacific Telephone and Telegraph Company in a verbal order issued by the Oregon Public Service Commission.

The commission likewise announced that the old rates in effect prior to January 1 between Portland and Oregon City and Salem are to be restored shortly. This, it was announced, will effect a saving of approximately $12,000 annually to the patrons of long-distance telephone service between these cities.

These orders of the commission followed the public hearing with reference to the airline rate which was put into effect by the Pacific Telephone and Telegraph Company, January 1, and which was ordered discontinued by the Public Service Commission.

While restoring to the people of Salem, Oregon City, Milwaukie and Oak Grove the former rates, which, it is said, are from 50 to 200 per cent less than the new rates adopted the first of the year, the commission at the same time put a stiff premiumm on telephone gossip as practiced over the telephone lines at Milwaukie and Oak Grove.

The rate as ordered by the commission of five cents for two-minute service between Portland and Milwaukie and Oak Grove places an additional five-cent charge for each additional five minutes. For service between Milwaukie and Oak Grove to Portland there will be no charge for the first five minutes of service, but a charge of five cents for each additional three minutes. The new rate, adopted January 1 by the company, was 10 cents for three-minute service.

The commission further ordered the telephone company to reimburse the telephone patrons of these two towns for all overcharges originating from the new rates since the first of the year.

Pennsylvania

The Meadville Telephone Company, operating in Meadville and Conneaut Lake, Crawford county, and adjacent territory, has filed with the public service commission a new tariff of rates, effective April 1, increasing the unit rates of the company and making them subject to a discount of 10 per cent if paid quarterly by the twentieth of the first month of each quarter or if paid monthly by the tenth of each month. The tariff established short term rates in which the rate for the short term period is higher than the proportionate rate of the corresponding annual rate.

The Albion Telephone Company, operating in Albion, Erie county, and adjacent territory, filed a new tariff, effective April 1, making advances of from $1 to $14 in the annual rates for telephone service. The new tariff provides that the annual rates shall apply only within a one and one-half mile radius of the exchange, and that beyond this zone there shall be an excess of $5 per annum per quarter mile of circuit or fraction thereof.

The Hopewell Independent Telephone Company, operating in Hopewell and Independence townships, Beaver county, filed a tariff effective April 1, making increases in the rate for residence service from $15 to $22.

The Edinboro Telephone Company, operating in Edinboro, Erie county, and adjacent territory, has filed a notice of increases effective April 1 in existing rates.

The new tariff further provides that an additional charge of $6 per mile will be made for private line service more than one mile from the central office.

The Consolidated Telephone Company, operating in Lehigh and adjoining counties, has appealed to the public

service commission for an order for the Palmerton Telephone Company to make a connection with its lines.

West Virginia

The Turkeyfoot Telephone Company, operating lines out of Holliday's Cove in Hancock county, has made application to the public service commission for authority to increase its rates on service to residents from $1 a month to $1.25 and to business houses from $1.25 a month to $1.50. It is asked that the new rates be made effective July 1.

Greenbrier county telephone subscribers and those in that immediate vicinity face higher telephone rates after April 1. The public service commission has the petition of the Limestone Telephone Company in which the company asks permission to increase its rates.

An increase of $3 per year is asked on residence and business telephones on grounded lines. The company now charges $15 per year for resident telephones and $18 per year for business telephones. An increase of from $24 to $30 is asked on private or business grounded lines owned by the company. Alderson, Ronceverte, Lewisburg, Union and White Sulphur Springs, W. Va., subscribers will be affected if the rates are granted.

Four dollars will be added to the telephone bills of Tyler county subscribers of the North Bend and Southern Telephone Company for yearly service. The public service commission granted the application of the company to raise its rate from $8 to $12 annually for this service.

W. M. Daniels Chairman of Interstate Commerce Commission

Secretary McGinty, of the Interstate Commerce Commission, issues the following memorandum:

Pursuant to the policy adopted January 13, 1911, that the term of office of the chairman of the commission shall be for one year, and that the office shall be filled from year to year in the order of seniority of service, Commissioner Winthrop M. Daniels has been unanimously elected chairman for one year, effective March 17, 1918, to succeed Chairman Hall.

For Fireside Strategists

(LIVY, BOOK XLIV, CHAP. 22.)

Lucius Aemilius Paulis, a Roman consul, who had been selected to conduct the war with the Macedonians, B. C. 168, went out from the senate house into the assembly of the people and addressed them as follows:

"In every circle, and truly, at every table, there are people who lead armies into Macedonia; who know where the camp ought to be placed; what posts ought to be occupied by troops; when and through what pass Macedonia should be entered; where magazines should be formed; how provisions should be conveyed by land and sea; and when it is proper to engage the enemy, when to lie quiet. And they not only determine what is best to be done, but if anything is done in any other manner than what they have pointed out, they arraign the consul, as if it were on trial.

"These are great impediments to those who have the management of affairs. * * * I am not one of those who think that the commanders ought never to receive advice; on the contrary, I deem that man more proud than wise who did everything of his own single judgment. What, then, is my opinion? That commanders should be counseled chiefly by persons of known talent; by those, especially, who are skilled in the art of war, and who have been taught by experience; and next, by those who are present at the scene of action, who see the country, who see the enemy; who see the advantages that occasions offer, and who, embarked, as it were, in the same ship, are sharers of the danger.

"If, therefore, any one thinks himself qualified to give advice respecting the war which I am to conduct, which may prove advantageous to the public, let him not refuse his assistance to the state, but let him come with me into Macedonia. He will be furnished by me with a ship, a horse, a tent; and even with his traveling charges. But if he thinks this too much trouble and prefers the repose of a city life to the toils of war, let him, on land, assume the office of a pilot. The city, in itself, furnishes abundance of topics for conversation; let it confine its passion for talking to those topics and rest assured that we shall confine ourselves to our military councils."

"Telephone Call Wire Conflicts"

Editor TELEPHONE ENGINEER: Following are a few remarks on an article in your February number, entitled "Telephone Call Wire Conflicts" (on page 64).

In this article it is stated that "the chance of c calls appearing in any given period is y^c." In this expression, y is the number of calls per hour multiplied by the length of each call in the fractional part of an hour. The statement is easily shown to be erroneous, as follows:

The chance of any given call *not* occurring in any given period is $(1-y)$, or, to use the values given in the example, $\frac{1199}{1200}$. Call $(1-y)=z$. The chance of *none* of the n calls occurring in the given period is z^n; in this case, $(\frac{1199}{1200})^{300}$. This is approximately 0.78. Since the total of all the changes must be 1, then 1—0.78, or 0.22, represents the chance that there are some calls in the period—i. e., any number, from 1 to 300. By Mr. Eddy's reasoning, the chances for one and one only in the period are 0.25, which is greater than the sum of the chances for 1, 2, 3, and so on up to 300.

The formula for the case under discussion, as given in any good algebra, is found in the expansion of $(y+z)^n$ by the binominal theorem, giving

$$y^n + n\,y^{n-1}z + \frac{n(n-1)}{2}y^{n-2}z^2 + \ldots + n\,y\,z^{n-1} + z^n$$

The chances of c calls appearing in the period are given by the terms in the expansion in which c appears as the exponent of y. The exponent of y in the last term is zero; and consequently, as stated above, the chance of no call appearing in the period is z^n.

Since $y+z=1$, $(y+z)^n=1$. That is, the sum of all the probabilities is unity, as should be the case.

The chance of one and only one call occurring in the period is $n\,y\,z^{n-1}$, or 19½ per cent (as compared with Mr. Eddy's figure of $n\,y$, or 25 per cent. This can be shown in another way, as follows: The chance of call No. 1 appearing and no others is equal to the produce of the chance of No. 1 appearing, y, by the chance of No. 2 not appearing, z, by the chance of No. 3 not appearing, Z, and so on to n. This gives $y\,z^{n-1}$ for No. 1. As there are n calls, the total chances are $n\,y\,z^{n-1}$.

R. E. CRANE, Boston.

The Kaiser as a Business Man

Over in Germany the government owns 97 per cent of the railways. If the kaiser and some of his friends decide it would be more profitable for them to have a certain district raise, say, sugar beets instead of wheat, the rate for shipping grain are placed so high the farmer has to grow beets at a loss to enrich the German sugar trust in which the kaiser and his friends have invested some of their millions. Soldiers in France and Liberty bonds at home will keep all that in Germany.

Telephone Patents Recently Issued

A Brief Digest of those Current Specifications Most Interesting to Telephone Men

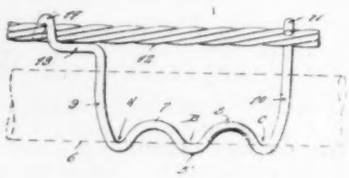
BY DAVID S. HULFISH

PATENT No. 1,238,748. Trunking System. Issued to H. D. Currier and R. I. Utter, assignors to Kellogg Switchboard & Supply Company, Chicago, Ill. The order circuit keys associated with the outgoing trunks have busy signals to show that the order circuit is in use.

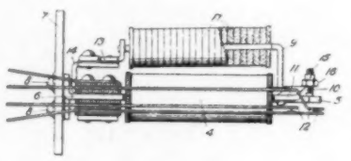
1,239,008. Magnet Winding. Issued to C. T. Henderson, assignor to the Cutler Hammer Manufacturing Company, Milwaukee, Wis. The conductor is wound bare with sheets of paper to separate the layers, the paper being perforated to facilitate filling the spool with an insulating compound.

1,239,097. Automatic Switching System. Issued to G. Grabe, assignor to Siemens & Halske A. G., Berlin, Germany. In adjusting the switches, a signaling connection is set up first and the speaking connection is set up afterwards, by associated switches.

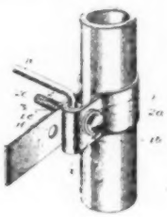
1,239,108.



1,240,169.



1,240,471.



1,241,898.

1,239,108. Cable Hanger. Issued to J. Kennedy, assignor to the Clements Company, New York, N. Y. A single piece of wire is bent to pass twice around the cable and to form three hooks over the messenger wire.

1,239,205. Party-Line System. Issued to T. E. Meyer, assignor to Automatic Electric Company, Chicago, Ill. (Application filed November 30, 1907.) The telephones are normally disconnected from the line by relays. The first telephone lifted upon a line operates its relays to connect the telephone to the line, but subsequent telephones cannot do so.

1,239,207. Linefinder System. Issued to G. E. Mueller, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. The searching linefinder is stopped in connection with the calling line by a circuit which includes the cut-off relay of the line.

1,239,357. Relay. Issued to H. D. Currier and L. Ericson, asignors to Kellogg Switchboard & Supply Company, Chicago, Ill. The armature has an ear extending into a slot in the return pole piece of the relay and acting to hold the armature in place.

1,239,587. Meter for Automatic System. Issued to R. C. Gifford, assignor to Automatic Electric Company, Chicago, Ill. A ratchet mechanism operates to make the meter ready to register by the act of calling, but only the act of answering by the called line completes the record. (Application filed November 14, 1906.)

1,240,169. Cable Hanger. Issued to Jasper Blackburn, Webster Groves, Mo. A single piece of wire is bent to grip the messenger and to support the cable, but does not completely surround the cable.

1,240,257. Party-Line Connector Switch. Issued to F. N. Reeves and A. E. Lundell, assignors to Western Electric Company, Inc., New York, N. Y. In connecting with a party line, the final connector of an automatic exchange has several positions, the positions all connecting with the same line, but the different positions connecting with different sources of ringing current to be applied to the line.

1,240,418. Selecting System. Issued to L. C. Bygrave, assignor to the Relay Automatic Telephone Company, Limited, London, England. When the first set of impulses is received by the central office, an apparatus determines whether the call is to terminate in the originating central office or in a distant central office, and if in a distant central office then a trunk is selected and preliminary impulses are sent to the distant office before the next series of impulses is received from the calling telephone.

1,240,471. Relay. Issued to D. D. Miller, assignor to Western Electric Company, Inc., New York, N. Y. A new design of slow-acting relay. Copper disks are carried by the armature.

1,241,898. Ground Clamp. Issued to H. B. Andrews, W. H. Hart and H. B. Sherman, assignors to H. B. Sherman Manufacturing Company, Battle Creek, Mich. A band surrounds the ground rod or pipe, a bolt draws the end of the band together, and a convenient socket for the end of the wire is formed in one end of the clamp band.

1,242,009. Changeover System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. The impulses are sine-wave for the numerical impulses from the telephone, the last impulse stopping abruptly, and the sudden stoppage of current then acting through an induction coil to effect the change over to the next numerical switch.

1,242,458. Party-Line System. Issued to F. Lubberger, assignor to Automatic Electric Company, Chicago, Ill. (Filed June 16, 1910.) In an automatic exchange, when a telephone user desires to call another station upon his own line, he merely lifts his receiver and operates a ringing button, which by central office apparatus sends ringing current to his line to signal the other stations according to code ringing.

1,243,721. Meter System. Issued to John Erickson, assignor to Automatic Electric Company, Chicago, Ill. (Application filed December 6, 1906.) When the subscriber operates the callsender, his telephone is rendered useless for speaking by a shunt around the transmitter. By operating a meter device the shunt may be removed and the telephone may be used for conversation.

1,243,747. Trunk Busy Circuit. Issued to F. Lubberger, assignor to Automatic Electric Company, Chicago, Ill. (Application filed June 10, 1909.) When a trunk is released by a selector, a locking relay preserves the busy test upon the trunk until after the apparatus of the trunk has been restored to normal and the trunk is again ready for service.

1,243,749. Meter System. Issued to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. After the first operation of the meter by response of the called line, the meter is placed under control of a clock and is operated repeatedly upon a long connection.

Loyal Operators

The operators of the Bell telephone system at Albany, Ga., have drawn up resolutions of loyalty to the government, pledging their co-operation in every way possible toward winning the war and establishing lasting peace and safety for democracy. Every operator, from the chief operator on down the list, signed the resolutions, which were turned over to J. W. Hargrove and forwarded to the district office in Savannah. Practically all of the operators at the various plants in southwest Georgia have forwarded similar resolutions, and all are equally patriotic and voice the same spirit of loyalty to the government and determination to help win the war by rendering more efficient service to the government and the general public.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers are Doing to Advance the Art

The Diamond Guy Rod Head

Guy Rods are used in very large quantities by telephone companies, railroads and telegraph companies. Rods used heretofore have been formed with a pear-shaped welded eye at one end and thread and square washer at the opposite end.

It is customary in setting anchors to drill a comparatively large hole and take a section of pole or railroad tie or other convenient piece of timber, bore a hole through it and anchor this at the bottom of the hole, filling in with dirt and stones.

The advantage claimed for the Diamond Guy Rod has to do only with the eye end, its use being in all other regards the same as any other ordinary guy rod. The illustration herewith shows that the Diamond Guy Rod Head is used by slipping through it a long rod with a square head on the end like a regular machine bolt. With the pear-shaped welded eye an ordinary wire rope thimble made of sheet steel is regularly used inside the loop formed by the guy rope. When a great strain is placed upon this thimble it collapses, or if the guy clamp creeps under the strain the thimble is pulled around with the creeping wire in the loop, is distorted, crushed and sometimes pulled entirely out of the eye. This leaves the rope in bad shape. It is bent to a shorter turn than is good for the wire, the galvanizing is flaked off and the wires strained to a point where they are likely soon to break through.

Fig. 1.

Fig. 2.

With the Diamond Guy Rod the head or eye through which the rope is passed requires no thimble. It has a semi-circular groove in which the rope rests. This groove is of large enough radius to give the rope an easy turn. Furthermore, the absence of welds or threads above ground is a great advantage. Some guy rods are formed with a head similar to this, screwed on to the end of the rod. These screw threads soon deteriorate from atmospheric conditions and welds are unreliable.

The Diamond Guy Rod is formed by using a square headed machine bolt of the length and diameter required in connection with the Diamond Guy Head. The square headed rod or machine bolt is easily passed through the open side of the guy head as shown in Figure 1, until the head is seated upon the base of the guy head, Figure 2. The Diamond Guy Head is of high quality malleable iron and in the 5/8 inch size capable of sustaining a breaking load of 30,000 pounds, or more than double the ultimate tensile strength of the 5/8 inch rod. Other sizes are in proportion.

The Diamond Expansion Bolt Company, New York, is the maker of this specialty.

Government "Drafts" a P. A. X. System

Uncle Sam and the keen officials who have been taught to look after his war interests have selected automatic telephone service for use in the various Twin City training schools, says Tri-State's *Our Emblem*. The best is none too good for the government, and automatic telephones combine those features which appeal most to those who have been trained in efficiency.

The equipment, originally installed at the Overland building, has been purchased for installation in the St. Paul Court House and City Hall. It was the intention to make the transfer at the conclusion of the automobile show.

When the government decided to take over the building for an aviation training school, company officials were advised that automatic service must be provided. Promises of immediate installations were of no avail. The officers knew that the building was thoroughly equipped with a P. A. X. and in spite of the fact that this machinery was intended for other purposes, insisted that it be not removed. "We need automatic service," they said, "and we've got to have it."

C. B. Crawford, St. Paul salesman, who handled the commercial end of the first order has given much of his time to the matter. On February 28 he delivered an order to the St. Paul local for 128 stations. Army officials praise automatic service very highly and additional equipment will be used in the near future.

Telephones on Pennsy

"Soon we will be handling trains by telephone instead of telegraph," said an official of the Pennsylvania Railroad.

Work of changing poles, wires and making other repairs was started some weeks ago in the local offices. It will be some time, however, before this work will be completed. It will include the two divisions between Pittsburgh and Columbus.

It is said that this step was taken by the Pennsylvania company on account of the scarcity of telegraph operators, many of whom were drafted into the army. They expect to have women working on jobs in places where they cannot get men.

Central Energy at Fairbury

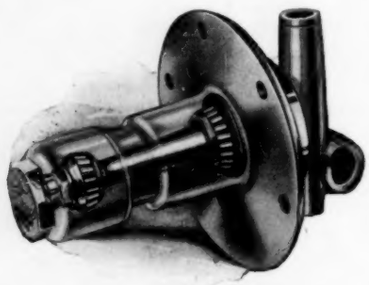
Progressive methods and sound management have increased the size of the system operated at Fairbury, Ill., by the Fairbury Telephone Company, to such an extent that present facilities have been outgrown.

The four-positioned local battery switchboard now in use will soon be replaced by a modern centrally operated multiple switchboard of the "Central Energy" lamp signal type, which will be arranged for an ultimate capacity of 1,000 subscribers' lines. The new central office equipment, now being manufactured by the Stromberg-Carlson Telephone Manufacturing Company at Rochester, N. Y., includes, besides the main switchboard, a complete set of terminal frames, cable racks, power and battery equipment and manager's desk equipment.

It is expected that the new exchange equipment will be cut into service on or about July 1, 1918.

Roller Bearings for the Ford

The Wright taper roller bearing in Ford size presents a practical and complete solution to any trouble experienced with Ford front wheel bearings. The bearing is based on a correct fundamental mechanical principle which allows a bearing with no cage or other trouble-making parts. It is stated to have 50 per cent more rolls than any other make of taper roller bearing of the same



The Wright Taper Roller Bearing.

dimensions, giving it maximum strength and ability to withstand wear. Its use in heavy commercial and passenger cars has proved its claims to be "The ultimate in the anti-friction idea."

Installed in the passenger Ford, it stops bearing troubles permanently, and its size and capacity allows the use of demountable rims with the assurance that the added weight will not break the bearing. In the commercial Ford or Ford unit, it adds a larger factor of safety and gives freedom from breakage. No mechanical changes are necessary, as it fits the Ford spindle.

The Wright taper roller bearing for Fords as shown in the cut is sold by the National Bearings Service Company, 727 North Broad street, Philadelphia.

Operators for France

The first group of thirty-three operators to be sent to France are ready for service. They will be attached to the Signal Corps, reporting to the Chief Signal Officer, and will occupy a unique position in the American military organization.

The group includes one chief operator, four supervisors and twenty-four operators. The blue uniforms and the hat, on which is worn the Signal Corps hat cord, were specified by the War College at Washington. The ranking of the operators is indicated by the devices embroidered on the white brassard, which is worn in accordance with the requirements of international law, as the operators are non-combatants.

On the brassard worn by a junior operator is embroidered a black telephone transmitter. The brassard of a supervisor has a laurel wreath underneath the transmitter, and the brassard of a chief operator has the two symbols mentioned, surmounted by a streak of lightning in yellow.

The second unit includes thirty-seven young women recruited from telephone exchanges from the Atlantic to the Pacific.

Although ten states are represented in the second unit, New York, Illinois and California furnished most of its members. The Chicago women who are awaiting orders to go are: Millicent Martin, Helen R. Orb, Drusilla Balmer, Evelyn Thomas and Marjorie Thomas.

Kinloch and Kellogg

The Kellogg Company has prepared for distribution to independent telephone men an eight-page picture booklet showing various exchange views of the Kinloch Telephone Company, of St. Louis, Mo. St. Louis is of special interest to the independent telephone man because there the first large independent multiple switchboard was installed. It was built and installed by the Kellogg Company in 1898, and is, after twenty years of constant usage, still giving excellent service, and will continue to do so for many years to come.

This is certainly a great achievement, because this board was built without precedent or previous experience in this line. The building of this board, in fact, stands out as a prominent point in the history of telephony.

This booklet shows the board as it is today, and as it was just after installation in actual service, proving conclusively that with Kellogg, "Use Is the Test."

Every independent telephone man should have a copy of this booklet. It may be had for the asking from the Kellogg Switchboard and Supply Company, Chicago.

Telephone Operators Wanted

Applications are in order for the immediate services of telephone operators for department service at Washington, D. C. The necessity is urgent and applications will be received from now until further notice. The salaries will range from $660 to $720. Applicants will be required to answer but two questions, the amount of education which will count 30 points, and the experience, which will count 70 points, making 100 counts in all. Competitors will be rated upon the sworn statement in their application and upon the corroborative evidence adduced by the commission. Applicants must have the equivalent of six grades of common school and must have had at least one year's experience as an operator in a large central office or at least two years' experience in any other branch exchange. Applications should be properly executed, excluding the medical and county officers' certificates, and filed with the civil service commission at Washington, D. C.

The New York City sales and distributing offices of Western Electric Company, Inc., formerly located at 463 West Church street, were removed on March 4 to 151 Fifth avenue, Broadway-Fifth Avenue building.

The S-C Instruction Book

The practical telephone man will find a wealth of information about the installation, wiring and equipment of local battery telephones in the Stromberg-Carlson Telephone Manufacturing Company's new Bulletin No. 1022, entitled, "No. 896 Telephone Instruction Book."

A representative of the Stromberg-Carlson Company states that this bulletin is issued not with the idea of selling the telephones described, but to give accurate and up-to-date information regarding the best methods of installing and caring for the instruments that have been sold, to obtain greatest efficiency and satisfaction from their use.

The bulletin describes all of the operations involved in the installation of a telephone from the shipping case to the wall in the subscriber's home. It explains how to connect up lightning arresters, how to make good ground connections, what sizes and kinds of wire to use, and numberless other practical hints.

Several sections of the bulletin are devoted to descriptions of the kinds of local battery telephone service in common use, all of which are profusely illustrated with circuits and wiring diagrams.

Bulletin 1022 is well worth writing for. Any person interested in telephones can obtain a copy for his use, free of charge, from the Advertising Department of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.

Growth of Radio Inspector's School

Because of the remarkable growth of the school for operators conducted at Boston by Radio Inspector Arthur Batcheller, of the United States Bureau of Navigation, it has been necessary to obtain larger quarters. A new term was opened January 21, 1918, in the Naval Militia Armory of that city, and the enrollment increased from forty, the number that received instruction in the class of July 16, 1917, to January 18, 1918, to the large total of 209, with facilities provided for the accommodation of 278 students. Of the forty who already have taken the course, twenty have enlisted in the Naval Radio Service, three have qualified for the Signal Corps, United States Army, Aviation Section, and eleven have obtained first or second grade commercial radio-operator licenses. The average attendance in the new term has been 162.

The adjutant general of Massachusetts granted free use of the armory that is occupied. The Massachusetts committee on public safety furnished the table equipment, janitor service, and lighting for the school. The telephones, keys, buzzers, etc., have been suppliled by the Bureau of Navigation. The radio apparatus used for the purpose of demonstrating has been loaned by the Marconi Wireless Telegraph Company, of New York, and the Wireless Specialty Apparatus Company, of Boston.

Preference of enrollment is given men in class 1, division A, of the selective service law, and young men eighteen years of age or over who are eligible to volunteer for service in either the army or navy. A circular letter has been addrssed to all the local exemption boards within a radius of 10 miles from Boston, bringing to the attention of the men subject to draft the opportunities offered by this school.

To properly instruct 278 students it was necessary to enlist the assistance of additional code instructors. The following have voluntarily offered their services: Joseph Furlong, Aaron Harris, Bartholomew McCarty, Miss Elizabeth Coolidge, Miss E. E. Rotch, and Miss Edith Sigourney. Messrs. Furlong and Harris formerly operated private stations, and Mr. McCarty was formerly a clerk in the office of the radio inspector at Boston. Misses Coolidge, Rotch and Sigourney hold commercial first grade radio operator licenses.

The school is under the supervision of Mr. Batcheller, assisted by Walter J. Butterworth, his clerk.

Government Takes Control of Platinum

The Council of National Defense has issued the following statement:

Through Ordnance Requisition No. 510 from the secretary of war, the Government has taken over control of the production, refining, distribution, and use of crude and refined platinum for the period of the war. The control will be exercised through the chemical division of the War Industries Board. The chemical division sent out today to the industry requests for inventories of the existing stock of crude and refined platinum and platinum-iridium alloys as of March 1, 1918.

The letter stated that it was not the intention of the Government to take over and handle directly the present stock of platinum, but to permit its shipment by the producers or dealers subject to certain conditions. Upon the fixing by the secretary of war of a reasonable price for crude, refined and alloyed platinum, notice will be given and blanks issued governing delivery and distribution.

The letter sent out by the chemical division includes the following directions to producers:

1. That producers, refiners and dealers in platinum continue to dispose of their product for Government purposes, and for that only, as directed by the chemical division.

2. That producers, refiners and dealers in platinum who are also consumers use platinum for Government purposes, and for that only, as directed by the chemical division.

3. That all obligations arising out of transactions in the production or delivery of crude, alloyed or refined platinum released as above, including all claims for shortage, poor quality, damage, or loss in transit, be borne by the producer or seller, as the case may be, in accordance with existing trade practices.

Distribution may be made by consent of this board through agencies under existing arrangements, provided that there results no increase over the existing price to the user.

The undersigned, on separate application in each case, will consider permitting the delivery of a limited amount of platinum for essential commercial purposes not for Government account.

Proper blanks upon which application for release of shipment should be made will be furnished on application.

The following list indicates, in general, the order of preference which will be followed in releasing platinum for shipment: First, military needs of the United States Government; second, military needs of allied governments; third, essential commercial ourposes.

The Telephone in Egypt

The British government has decided to acquire the Egyptian telephone service for 755,000 Egyptian pounds ($3,870,000).

The government has taken over the telephone service from January 1st, and will pay interest at 5 per cent until the completion of the purchase.

The directors of the Oriental Telephone and Electric Company are issuing a circular to their shareholders announcing that the Telephone Company of Egypt has accepted an offer from the Egyptian government for the purchase of their undertaking at the price named. The purchase has been approved by the Council of Ministers. After payment of the debentures of the Egyptian Company, which amounts to about $900,000, and the liquidation of all other claims upon that company, almost the whole of the net proceeds will belong to the Oriental Telephone Company, which owns practically the whole of the shares in the Egyptian Company. The Egyptian Company's capital is $1,000,000 in $5 shares, of which $900,000 is preferred and $100,000 in deferred shares. The Oriental Company has an issued capital of $866,565 in $5 common and $250,000 in $5 preferred shares.

Get License Before Using Explosives

Nearly every user of explosives knows that Uncle Sam has passed a law requiring all users of and dealers in explosives to take out a government license. To those who may not be clear on the matter, a little information may be in order:

The object of the law is to keep dangerous explosives out of the hands of plotters and alien enemies of the country.

Before a dealer can sell any explosives, he must have a license, and before a customer can purchase any explosives, either from a dealer or a manufacturer, he must have a license. Before a customer can secure delivery from a railroad company or any explosives shipped to him, he must show the railroad agent his license.

This license matter is, however, a very simple proposition. It need not deter any one from buying or using explosives if their motives are honest. The license costs only twenty-five cents and can readily be obtained from licensing agents located in every state and every county. As a general thing, county clerks are the proper persons from whom licenses can be secured.

However, anyone having any difficulty in locating a licensing agent can obtain the name and address of the nearest agent by writing Bureau of Mines, Explosives Division, Washington, D. C. Dealers stocking explosives will, of course, be able to give customers addresses of licensing agents.

In order to save time, it will be well for any person desiring to purchase explosives to obtain his license before going to his dealer to place an order. If he intends ordering direct from a manufacturer, he must necessarily have his license before ordering, because a certified copy of the license which will be furnished by the licensing agent must accompany his order.

In the Russian Revolution

During the Russian revolution, A. E. Reinke, of the Western Electric staff, occupied a not altogether enviable position in Petrograd. That his serial story of his experiences, as printed in the *Western Electric News*, is interesting, goes without saying. Of the local telephone operating situation he says:

"As one grew accustomed to walk on the thin crust of this boiling volcano, much happened that was reminiscent of excellent comic opera. Employes everywhere had organized committees to help the managers of concerns run their business along new and improved lines. The Petrograd telephone exchange in this way produced some good material for a libretto. The exchange is owned and operated by the city, and serves 56,000 lines connected to a single office. The operators and trouble men organized a union early in the game and promptly discharged the manager and chief engineer. These easy jobs were then turned over to a couple of linemen, elected to the position. A week later they resigned, completely satisfied with the experience. A wireless expert next came forward. As to qualifications, he advised the union that he carried the usual number of ears, eyes, fingers, toes, etc., making an interview unnecessary. When asked by the union whether he wanted the job, he spoke of his wish of long standing to want to sit on a keg of powder. That clinched the proposition. A few weeks satisfied both his desire and curiosity. A third candidate was found with great difficulty, and ejected with ease. In October a young cable tester, fortunately with a technical training, was elected chief engineer, for how long can be surmised. What became of the service while operators were experimenting in setting up various forms of self-government within the building may be imagined.

"The operators of the Moscow telephone exchange threatened to strike if the chief operator was not discharged. The exchange mechanics at once threatened to strike if she were. The subscriber patiently waited, while the telephone forces were settling their private feuds."

Claims in Patents

The practice in the United States with reference to drawing patent claims has been criticized from time to time because of the difficulty in determining what is the new feature in a combination where the old as well as the new elements are positively included. While such a claim may define the combination as a whole, it does not distinguish the new from the old, and it is, therefore, necessary for an attorney in construing a patent to make a study of the prior art to ascertain in what the improvement consists.

In some countries an entirely different practice has been followed in drawing claims, the inventors' attorney being obliged to draw the claims in such a manner that when the claims are read, there may be no confusion of the improvement with the elements old in the art. When this is done, any attorney may at once see in what the invention consists. In the countries where this practice is followed, the patent offices hold that unless the improvement is distinguished from the old elements in the claim, the invention is not defined as is required by the law. In other countries it is necessary that a carefully prepared statement of the prior art be included in the specification which makes it possible from an examination of the letters patent to determine the extent of the invention and the scope of the claims in the letters patent.

Until recently the United States Patent Office has not looked favorably on claims in which the improvement in the combination is distinguished from the old elements, but the advantages which would arise from the use of this form of claims have been apparent, and after much discussion the practice has been approved in Ex Parte Jepson.

While it may still be advisable in certain cases to draw patent claims in accordance with the old practice, there are many cases in which attorneys should take advantage of the recent ruling.—*Scientific American.*

Win-the-War Spirit in Letters

"See that a win-the-war spirit gets into your business letters," is the slogan of a movement launched by the Department of Commerce to remind business men that the every-day business letter is a most effective instrument for creating confidence in the government's war policies and for inspiring others with the determination to see the war through at any cost.

"The idea was first brought forward in connection with American business letters to foreign countries," said Secretary Redfield. "The volume of our foreign business mail is very large. It reaches firms in all but the enemy countries. For the most part it is read by those who are for us, but you may be sure that it reaches many who doubt our success and many who are at heart against us. I am sure that every foreign business man who opens an American letter is quick to detect even the slightest indication of the writer's feelings on the conduct of the war and its outcome.

"It is of the utmost importance, therefore, that the American business letter breathe confidence in every line.

If the manufacturer or exporter feels that he has a just grievance against restrictions imposed on his trade, by all means let him go right to headquarters and register as emphatic complaint as he feels is justified. But he certainly should not carry the matter into his business letters. It is sure to create an entirely erroneous impression in some minds.

"Let the American business man make known to the whole world that he is for this war and that he is going to see it through, regardless of inconvenience, loss of trade, loss of money, or anything else. Every manufacturer ought to be fearless in expressing his sentiments even though he may be writing to a concern whose sympathies he may suspect are not wholly with us. Don't give a foreign concern the idea that you are apologizing for your government's restrictions or that you are chafing under them. Spread the impression, the absolutely correct impression, that over here we are backing this war unqualifiedly."

Keystone Earnings

Earnings for the year 1917 of the Keystone Telephone Company of Philadelphia, which includes the Keystone Company of New Jersey and the Eastern Telephone and Telegraph Company, amounted to a net balance of $412,179, compared with $399,823 the previous year.

Gross earnings were $1,639,299. From this was deducted $891,850 for operating and maintenance charges, including taxes; $747,449 for interest and reserve, and $12,179 for interest charges, leaving the net at $412,179.

In his report to stockholders, N. T. Folwell, president of the company, says that the total capital expenditures of the year were $371,713, and that a large part of that amount was provided out of earnings credited to the renewal reserve fund, the balance being obtained by the sale of $100,000 of the company's bonds. The total of Keystone company's bonds sold to date is $6,525,000.

"In addition to rapidly increasing operating costs," says Mr. Folwell, "we have had to meet a very large increase in taxation for war and general public purposes. For this provision has been made by way of a reserve."

Michigan Traffic Association Elects

A net increase of 6 per cent in the business of the Michigan Independent Telephone & Traffic Association was reported for the last six months in 1917 at the annual meeting of the stockholders. Roy F. Mapes, who was elected secretary and treasurer, was the only officer named who was not re-elected. Other officers are: President, C. E. Tarte, Grand Rapids; vice-president, W. J. Melchers, Owosso; directors, C. E. Tarte, W. J. Melchers, W. A. Bahlke, R. C. Smith, L. L. Conn, Thomas Bromley, Jr., A. E. Wells, N. F. Wing, W. B. Serviss, J. P. Gibbs, C. E. Smith, Roy F. Mapes, C. G. Fitzsimmons, A. H. McMillan and G. L. Hall.

Dredgers Must Pay Cable Damage

Judgment for the Chesapeake & Potomac Telephone Company of Virginia against the Coastwise Dredging Company, in the sum of $650, for injury to the submarine telephone cable between Norfolk and Portsmouth, was rendered in the United States court.

The injury complained of occurred a number of months ago. A barge that had been sunk was being towed into harbor and dragged bottom, tearing into the cable and deranging the service between the two cities for a time.

Savings in Telephone Restaurants

By fully co-operating with the Food Administration on meatless days, the restaurants of the Philadelphia telephone system are saving meat at the rate of about 25,000 pounds a year, according to the *Telephone News*, and Restaurant Supervisor Steelman has had little difficulty with wheatless days because a special service of corn muffins has been even more in demand than white bread. Three cooks prepare these muffins and they gain in palatability by being served hot. An electric meat chopper is used to cut fat into fine pieces, which are rendered and the fat used for frying and shortening. The kitchen also saves remnants of fresh fruit by canning, preserving and turning them into homemade jams and jellies. The quantity recipe for corn muffins is as follows, making 150 muffins, 6 quarts of corn meal, 3 quarts of wheat flour, 1 pound brown sugar, ½ pound lard, ½ pound butter, 10 ounces baking powder, 3 ounces salt, 9 eggs, 5 quarts milk. Mix and sieve all dry ingredients, work in butter and lard thoroughly, stir the beaten eggs in milk and add. Beat until smooth and bake in greased muffin tins in quick oven.

Data on Electrolysis

The Bureau of Standards, Washington, D. C., has published a digest of all its publications on Electrolysis of Underground Structures Caused by the Disintegrating Action of Stray Electric Currents from Electric Railways. The work was prepared by Samuel S. Wyer, consulting engineer, Columbus, Ohio.

Although the book of 100 pages is devoted mainly to the consideration of pipe line damage by electrolysis, there is much in it that applies directly to lead-covered underground telephone cables, and the well informed telephone man will doubtless want one in his library. Copies may be obtained from the Bureau of Standards.

Wire Tapping Bill Passed

The New York state Senate, by a vote of 43 to 3, passed the Murphy bill, designed to prevent the tapping of telephone lines. Under its provisions, permission to "listen in" can be granted only by the Chief Justice of the Appellate Division in each department, or by three justices named by him.

An amendment offered by Senator Courtlandt Nicoll, to give jurisdiction to district attorneys and other peace officers, was beaten.

The New York Directory

The spring issue of the New York City telephone directory, now being delivered, contains the names of 436,000 telephone subscribers on 1,008 pages, and will have a circulation of 731,500 copies.

The telephone company is also issuing new telephone books to its subscribers in New Jersey, Westchester and Rockland counties, N. Y., and Long Island, so that the directory distribution in the company's metropolitan territory this month will total 1,016,000 books.

To the U. S. Signal Corps

You could get along without the infan-tree,
If such a thing should really have to be;
You could let up on "typewritin',"
Quit most other styles o' fightin',
And keep a battle goin' 'cross the sea;
But I'll make an affidavy at my dear old mother's knee
There wouldn't be no battles in the trenches 'crost the sea;
Oh there wouldn't be no chanst for them to carry on the war,
Without the kind assistance o' the U. S. Signal Corps.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

PERSONAL NOTES.

Ben Marvire will take the place of Mr. Behmer as manager of the Xenia, Ohio, Telephone Company.

John Poole, president of the Federal National Bank of Washington, D. C., has entered upon his new duties as a director of the Chesapeake and Potomac Telephone Company's branches in Washington and Baltimore.

D. S. Porter, formerly division commercial manager of the local branch of the Chesapeake and Potomac Company, has been promoted to the position of secretary-treasurer of all the Chesapeake and Potomac companies.

W. B. Clarkson, for the last seven years division manager of the Central District Telephone and Telegraph Company (Bell), at Pittsburgh, Pa., and formerly contract manager of the local branch of the Chesapeake and Potomac Company, has been promoted to the position of general superintendent of all the Chesapeake and Potomac branches.

John E. Boisseau, manager of the C. & P. Telephone Company at Baltimore, Md., has been promoted to a similar position with the company at Philadelphia, Pa.

Walter B. Clarkson, formerly division manager of the Bell Telephone Company at Pittsburgh, Pa., has succeeded S. M. Greer, who recently resigned, as general commercial superintendent of the C. & P. Company.

George H. Inkner of Johnstown, Pa., has been promoted from manager of the Central District Telephone Company, to manager of the Johnstown District which comprises 16 exchanges of the company.

P. L. Bach of Springfield, Ill., who had been doing special work for the Central Union Telephone Company at Rockford for a week, died recently at St. Anthony hospital. Dr. Carl A. Peterson attributes Mr. Bach's passing to a chronic heart trouble.

E. Predmore, formerly manager of the local telephone company at Scranton, Ia., is the new manager of the Sac County Farmers' Mutual Telephone system at Sac City.

Frank Baker has been given a promotion by the Iowa Telephone Company. He has been made manager of the Pocahontas exchange together with three other nearby exchanges.

Walter B. Clarkson has been elected to the general commercial superintendency of the Chesapeake and Potomac Telephone Company of Baltimore, Md., to succeed Samuel M. Greer, who resigned to become vice-president of the Bankers' Trust Company, New York.

Robert W. Smith, who for the past six years has been president of the Newark Telephone Company, retired from office, having disposed of his interest in the company. Mr. Smith's place on the board of directors was taken by Charles E. Hollander who was also elected secretary of the company.

Announcement by the Bell Telephone Company of the appointment of Andrew Schultz, of Camp Hill, to plant engineer in Pittsburgh, effective March 1, and the filling of the office of the plant engineer at Harrisburg, which will be vacated by Mr. Schultz, by Robert C. Glancy, formerly of Harrisburg, but now construction engineer at Philadelphia.

W. S. Bramlett has been appointed general solicitor for the Southwestern Telegraph and Telephone Company with headquarters at Dallas. Mr. Bramlett has represented the telephone company in Texas for twenty-two years.

Claude L. Miller, former head of the Delevan, Wis., telephone exchange, and afterward Wisconsin exchange, has resigned his position to take one with the Guardian Life Insurance Company.

At a meeting of the directors of the St. Croix, Wis., Telephone Company, which was held recently, it was decided to select Melvin Halverson, city electrician, as manager of the telephone business to succeed the late P. C. Harmon.

George E. Merrill of Andover, Mass., has succeeded Harold F. Jackson as Ayer district manager for the N. E. Tel. & Tel. Co., taking up his work there immediately. He has been contract agent and collector for the company at Lawrence.

T. L. Dunlap, formerly engaged in the telephone business in Springfield, Mo., has been made special agent for the Texas Long Distance Telephone Company with headquarters in Sherman. He also has the special work of overseeing the operation of the company's toll lines north of Dallas.

George H. Glass, for seventeen years general manager of the Citizens Telephone Company at Pekin, Ill., has tendered his resignation. Mr. Glass will go to Columbus, Georgia, where he has accepted a position with the telephone company there.

Announcement has been made of the appointment of T. T. Cook as publicity manager of the Chesapeake and Potomac Telephone Company at Baltimore to succeed J. E. Boisseau, who recently went to Philadelphia to take a similar position with the Bell Telephone Company, of Pennsylvania.

A. F. Wyman, manager of the Pacific Telephone and Telegraph Company at Dayton, Wash., has accepted a position in the New York office of the company.

Percy Chase Harmon, secretary-manager of the St. Croix Telephone Company, New Richmond, Wis., was killed in Warren, O., near Cleveland, when an automobile in which he was a passenger, was struck by a trolley car. Mr. Harmon built the rural telephone lines out of Clear Lake, installed the telephone system in Miltown, Polk County, and was engaged in telephone work for a short time in Snokomish, Wash.

S. G. Smead, manager of the Bell Telephone Company, at Williamsport, Pa., died recently of spinal meningitis.

J. A. McCoy, secretary of the Telephone employes association of New England, died recently at Somerville, Mass.

H. L. Beatty of Ravenna, Miss Louise Butler of New York City, Horace Hine of Mantua, Frances Seiberling of Akron and Fred Smith of the latter city have sold their holdings in the Portage County Telephone Company to Frank L. Beam of Mt. Vernon, Ohio, a large telephone stockholder owning or controlling a score of telephone companies in central and southern Ohio.

S. G. Smead, late manager of the Bell Telephone Company of Pennsylvania at Williamsport, died recently at his home there after several weeks' illness. He was in the service of the Telephone Company for twenty-six years.

Merritt Baker Clark, superintendent of accounts at the Boston offices of the New England Telephone & Telegraph Company, and connected with the company for eighteen years, died at his home in Dorchester.

NEWS FROM THE FIELD.

CALIFORNIA.

At the annual meeting of the California Light and Telephone Company at Santa Rosa, the directors elected the following board of directors: A. F. Hockendeamer, Leonard Howerth, G. K. Weeks, Leo H. Susman, Frank P. Doyle, W. P. Ferguson and A. Sbarboro. The directors organized by electing Leo. H. Sussman, president; and William P. Ferguson was elected general manager, secretary and treasurer.

The Redondo Home Telephone Company of Oakland has filed an application for an extension until December 31, 1918, of the time within which to comply with the laws of the state of California regarding pole line constructions.

At the annual meeting of the Pacific Telephone and Telegraph Company all outgoing directors were re-elected to serve for the ensuing year. The directors organized after the meeting and reelected old officers and also declared the regular quarterly dividend of 1½ per cent on the preferred stock.

COLORADO.

A new telephone company is being organized by Peetz residents. It will be home-owned and will connect with many of the farms in the Peetz section.

GEORGIA.

At the annual meeting of the Southern Bell Telephone & Telegraph Company of Atlanta the following directors were elected: W. T. Gentry and J. Epps Brown, Atlanta; U. N. Bethel, George D. Milne, N. C. Kingsbury, Theodore N. Vail and Charles H. Wilson, New York. Officers were reelected as follows: W. T. Gentry, president; J. Epps Brown, first vice-president; J. M. B. Hoxsey, second vice-president and treasurer; Leland Hume, third vice-president; Addison Maupin, secretary and assistant treasurer; C. J. Holditch, auditor.

James E. Caldwell, formerly president of the Cumberland Telephone and Telegraph Company and now chairman of the board of directors of that company, inspected the new Hemlock telephone central office of the Southern Bell Company and declared it was the finest telephone office he had

ever seen in his thirty-six years' experience in the telephone business.

IDAHO.

The telephone system at Dubois has been installed and is in working order. At the present time there are forty-five telephones connected in the town with others contracted for. Rural lines have been built out to neighboring ranches. It is now possible to call people of Dubois on the long distance without having to send a messenger for them to come to the central office.

ILLINOIS.

The Chicago Telephone Company reports for January: Gross increased $111,551; net decreased $87,108; operating income decreased $117,664.

Chicago's corporate fund has been made richer by $300,494. A check for that amount has been given the city controller by the Chicago Telephone Company. The amount represents 3 per cent of the company's gross business for the last six months of last year, as required under its ordinance.

The annual meeting of the Geneseo-Munson Telephone Company was held recently in Geneseo. The following officers were elected: President, Walter Cady; vice-president, J. F. Tomlinson; secretary-treasurer, Fred A. Offerle; directors, Henry Ruxton and J. L. Lamont. Linemen: Geneseo, Sherman McAvoy, and for the country, Lee Young.

The Highbridge Telephone Company of Canton held its annual business meeting and elected the following officers for the ensuing year: President, A. K. Rennie; secretary-treasurer, J. T. Hillery; switchboard committeeman, Robert Rennie; linemen, Scott Fisher, Alva Hedden and Elmer Weaver.

The stockholders of the Mutual Telephone Company met in Hillsboro recently and re-elected the following directors: Dr. V. A. Bost, Fillmore; E. Harris, Coffeen; M. Pence, Sorento; and A. L. Schwab, Litchfield. They were elected for a term of three years.

The officers and directors of telephone line No. 111, Canton, re-elected directors and officers at a meeting held recently, the only exception being Harvey Henderson, elected as a director to fill the place of Lee Moran.

The Freeport Telephone Exchange Company, incorporated April 5, 1910, to operate a telephone exchange in Freeport and within a radius of thirty miles of that city, certified to Secretary of State Emmerson to a dissolution as a corporation and surrendered its charter. The president of the company is Roy K. Farwell and the secretary is J. B. Farwell.

The Cheneyville Telephone Company of Cheneyville has been incorporated with a capital of $3,000 by D. N. Heaton, Frank Reitz and Ray M. Brougher.

The Skinderviken Telephone Equipment Company of Chicago has been incorporated with a capital of $10,000 by J. Skinderviken, Olafe E. Ray and Jennie Johnson.

INDIANA.

The Turman Township Telephone Company of Sullivan has elected the following officers: J. N. Weir, president; E. C. Eno, vice-president; O. H. Burke, secretary; J. W. Medsker, treasurer; J. N. Weir, E. C. Eno, O. H. Burke, J. W. Medsker, Charles Wible, Walter Weir and A. G. Cushman, directors.

The Home Telephone Company of Elkhart has filed a petition for increasing its capital stock to $300,000.

The Duboise County Telephone Company of Elkhart has filed a petition for increasing its capital stock to $35,000.

The directors of the Farmers' Mutual Telephone Company of Vevay has elected officers as follows: Dennis Manning, president; James Crandell, treasurer; Wm. Patton, secretary.

IOWA.

The Grinnell Farmers' Telephone Company, an organization recently formed of the rural mutual lines extending out of Grinnell, elected the following temporary officers: W. M. Simmons, president; George Hafkey, vice-president; T. A. Harris, treasurer; Harvey McFate, secretary.

Stockholders of the Mutual Telephone Company in Jefferson had a meeting recently, at which officers were all re-elected as follows: W. A. McDonald, Sr., president; S. Flack, vice-president; J. A. Henderson, secretary; S. J. Sayers, treasurer; committee on central operation, G. W. Munn, Harry Harding and J. A. Henderson.

In a recent meeting the following officers were elected by the Excelsior Telephone line of Sweetland township: President, Lloyd Taylor; vice-president, Joe Beiver; secretary, Herman Leonhardt; treasurer, Charles Norcross; director, one year, Herman Koepping.

KANSAS.

The Flora Telephone Company of Flora, Kansas, has been incorporated with a capital of $900.

The directors of the American Independent Telephone Company have authorized the purchase of a new switchboard for the Holton exchange. The company will be at between $6,000 and $7,000 expense in installing the new board, but the manager and directors are determined to give the patrons the best service possible.

KENTUCKY.

At a meeting recently held of the Rural Telephone Company of Fulton the following officers were elected to serve for the ensuing year: Amos Colley, president; Dud Jones, vice-president; Alvin J. Burrow, treasurer; Gus Browder, secretary; directors, T. N. Rawls, Sam Reed, A. P. McKinney, G. W. Smith.

Hazel Green Valeria Home Telephone Company, Valeria, has been incorporated with a capital of $210. Incorporators are B. T. Helton, Shiloh Swango and Roy Cannoy.

MAINE.

At the annual meeting of the County Telephone Company of Augusta the following officers were elected for the coming year: President, E. D. Chase; vice-president and business manager, C. M. Whitney; secretary, A. L. Ester; treasurer, C. S. Cook; directors, F. A. Whitehouse, C. M. Whitney, C. C. Fowler, L. D. Smith, A. L. Estes, F. J. Conner, L. I. Bussey, R. E. Stone.

At the annual meeting of the Kennebec Farm & City Telephone Company of Waterville, C. W. Green of Fairfield was elected president; Frank L. Ames of Norridgewock treasurer and manager; Clinton H. Goodhue of Waterville, clerk; and James Tebbetts of Belgarde, auditor.

MASSACHUSETTS.

At the annual meeting of the New England Telephone Company all the officers were re-elected as follows: President, Phillip L. Spalding; first vice-president, Matt B. Jones; vice-preisdent, Edmund W. Longley; secretary, Carl F. A. Siedhof; treasurer, John Balch; directors, Charles F. Ayer, Union N. Bethell, Samuel P. Colt, Francis H. Dewey, W. Cameron Forbes, Matt B. Jones, Henry W. Keyes, George D. Milne, Henry D. Sharpe, Joseph A. Skinner, Charles P. Smith, Philip L. Spalding, Bernard W. Trafford, Theodore N. Vail, Edward B. Winslow.

New England Telephone & Telegraph Company at Worcester was given permission to obstruct a portion of West Boylston street to construct manholes.

MICHIGAN.

The Pere Marquette, Saginaw, has just added a new circuit to its telephone dispatching system, this leaving just two divisions of the road to be supplied with the system. The division on which the new system was installed is that extending to Elmdale and Grand Ledge. The new line is of the latest type and is giving excellent satisfaction.

All officers of the Michigan Independent Telephone & Traffic Association at Grand Rapids have been re-elected with the exception of Roy F. Mapes, who was elected secretary and treasurer in place of Frank V. Newman, who resigned recently. The officers are: C. E. Tarte, Grand Rapids, president; W. J. Melchers, Owosso, vice-president; Roy F. Mapes, Grand Rapids, secretary and treasurer; board of directors, C. E. Tarte, W. J. Melchers, W. A. Bahlke, R. C. Smith, L. L. Conn, Thomas Bromley, Jr., A. E. Wells, N. F. Wing, W. B. Serviss, J. P. Gibbs, C. E. Smith, Roy F. Mapes, C. G. Fitzsimmons, A. H. McMillan and G. L. Hall.

The Fostoria Telephone Company of Fostoria has been incorporated with a capital of $10,000.

The Kingston Telephone Company of Kingston has been incorporated with a capital of $19,000.

The capital stock of the Moffatt Telephone Company of Moffatt has been increased from $564 to $1,200.

MISSOURI.

The papers showing transfer of the property of the Clay County Telephone Company of Liberty to the Liberty Telephone Company were filed in the office of the recorder showing all property sold except the Missouri City exchange. The consideration is shown to be $23,521. Work is now going on rapidly and it is hoped the consolidation will be perfected soon after April 1.

MONTANA.

Articles of incorporation have been filed by the Farmers' Mutual Telephone Companw of Moccasin. The company is capitalized for $25, and the directors are W. F. Kruckeberg, G. B. King, B. E. Blackman, A. K. Raundal, Homer Wright and C. M. Todd. The company will operate a telephone line between Danvers, Kolin, Moccasin, Benchland, Windham, Utica and Denton.

NEBRASKA.

The Farmers' Telephone Company of McLean elected the following officers: E. E. Benson, president; Fred Wupper, secretary-treasurer; Robert Korth, director.

NEW YORK.

A deal has just been consummated whereby the New York Telephone Company (Bell system) has purchased the entire system of the Federal Telephone Company, which operates very extensively in the south central and western counties of New York state. The Federal system will continue as at present until the New York

company can make arrangements to "cut over" into the Federal system.

The following companies have merged with the Federal Telephone and Telegraph Company: Caroline Telephone Company, Canaseraga Telephone Company, Dunkirk Home Telephone Company, Hanover Telephone Company and the Niagara Home Telephone Company.

NORTH CAROLINA.

The Churchland Telephone Company of Churchland has recently been organized with O. T. Davis as president and S. R. Simmerson as secretary and treasurer.

NORTH DAKOTA.

The Woodlake Telephone Company has been incorporated in Tokio with C. D. Graves, R. A. Tomlinson and J. L. Graham as directors, with a capital stock of $3,000.

OHIO.

The Citizens' and Bell Telephone Company of Coshocton expect to complete the county and city merger by April 1, providing the State Utilities Commission indorses the plans very soon. Neither company will accept payment of rentals in advance beyond April 1, after which date the new rate, embodying an advance of 50 per cent, will be put into effect, and a subscriber on either system will be able to talk to all parties on both systems without charge.

Central Union Telephone Company and the Independent Telephone Company at Urbana have consolidated.

The Cincinnati and Suburban Bell Telephone Company has been authorized to increase its capital from $12,000,000 to $16,000,000. For the present no additional stock is to be issued.

The Cincinnati and Suburban Bell Telephone Company has been authorized by the secretary of state of Ohio to increase its capital from $12,000,000 to $16,000,000. The increase was approved at the recent annual meeting by the stockholders. For the present no additional stock is to be issued.

The Harpersfield Telephone Company recently held its annual meeting and elected the following officers: President, R. P. Phillips; vice-president, J. Gray; secretary and treasurer, E. H. Rawson; directors, J. Waring, S. A. Craig, Geo. Staltz, O. C. Buck, S. V. Warram, C. J. Carmichael, H. W. Burchholder, E. S. Morris, H. C. Sparr; auditing committee, John Lister, H. Frisby, J. Craig.

At the last business meeting of the directors of the Harrison and Jefferson Telephone Company of Steubenville the following officers were elected: President, W. C. Clifford; vice-president, Samuel Hall; treasurer, A. P. Sheriff; secretary-manager, J. F. Smith.

At the annual meeting of the stockholders of the Millersburg, Wooster and Orrville Telephone Company, the present officers of board of directors were re-elected for the coming year as follows: President, C. M. Lovett, Wooster; vice-president, Frank L. Beam, Mt. Vernon; secretary and general manager, M. M. Herron, Millersburg; treasurer, H. W. Cary, Millersburg; board of directors, Frank L. Beam, Mt. Vernon; A. N. Brenneman, Orrville; H. W. Cary, Millersburg; Frank Griffith, Orrville; M. M. Herron, Millersburg; C. M. Lovett, Wooster; H. M. Rudy, Millersburg; T. E. Steiner, Wooster; and O. Troutman, Shreve.

The Cecil Telephone Company and the Mutual Telephone Company, with headquarters at Cecil, have merged their telephone interests and lines. The new company is now known as the Cecil Mutual Telephone Company.

At the annual meeting of the Ohio State Telephone Company all the present directors were re-elected with the exception of William Hardee, Toledo, who retired, the position being taken by Daniel McLaren, Cincinnati. President C. L. McVey, Cleveland, was re-elected president; Frank L. Beam, Mt. Vernon, vice-president; W. L. Cary, Columbzus, vice-president and secretary; H. B. Taylor, Columbus, treasurer; C. J. Queen, Columbus, auditor; and F. A. Davis, Columbus, chairman of the board of directors.

OKLAHOMA.

As soon as two construction gangs working toward each other stringing wire between Oklahoma City and Lawton, finish their work, eight persons in the former city can talk to eight persons in Lawton at one time, instead of six, as at present. To make this possible the Southwestern Bell Telephone Company is building the two additional toll circuits and with copper wire at its present high price, according to A. W. Bogenschuts of the telephone company's advertising service, this one piece of construction work will cost the company probably 50 per cent more than before the war. One gang is working toward Oklahoma City with Apache as its headquarters, and one gang is working toward Lawton with Tuttle as its headquarters. The distance between the two cities, as followed by the surveyors in laying out the route, is ninety-four miles so that the company's workers are putting up 188 miles of wire in order that the two cities will have the eight circuits.

Harry Lyon, manager of the Muskogee branch of the Southwestern Bell Telephone Company, announced that plans were complete for the construction of a new telephone line connecting Oklahoma City and Muskogee. Astual work will start at once, he said.

Victor Telephone Company, Carmen, has been incorporated with $500 capital by Albert J. Boyce, George W. Salwaechter, H. V. Jordan, Carmen.

OREGON.

The North Fork Co-operative Telephone Company, with offices at Florence, has filed articles of association. The incorporators are: J. E. Watkins, John H. Bower, R. R. Ray, E. R. McCornack and L. C. Akerly. The company will run a telephone line from Florence and Cushman.

Common stock of the Pacific Telephone Company has advanced to $24.75. The increased strength of this stock is attributed to the company's prosperous business during the year 1917.

North Fork Co-operative Telephone Company, Florence, has been incorporated with capital stock of $2,500. Incorporators, J. E. Watkins, John H. Bower, R. R. Bay, E. R. McCornack, L. C. Akerly.

PENNSYLVANIA.

The Keystone Telephone Company of Philadelphia for the year ended December 31 reports net profits of $412,178, an increase of $12,355, or 3.09 per cent over 1916.

Stockholders of the Central District Telephone Company will meet at Pittsburgh April 26 to take action on the proposed sale of the Central District Telephone stock, franchises and property to the Bell Telephone Company of Pennsylvania for $108.75 a share. Both companies are subsidiaries of the American Telephone and Telegraph Company.

The Perry County Telephone and Telegraph Company has its linemen at work placing new arms on the poles of the line extending from Blain to New Germantown, on which new wires will be strung to divide the New Germantown line, containing thirty phones.

Stockholders of the Orangeville United Telephone Company recently elected the following officers for the ensuing year: President, C. C. Whitmoyer; vice-president, Ray Trump; treasurer, M. F. Bowman; secretary, G. M. Whitmoyer. It was decided to make a number of improvements to the line which covers the territory through Orange, Fishingcreek and Greenwood townships during the summer months.

SOUTH CAROLINA.

The Cope Telephone Company of Cope, Orangeburg county, has been commissioned by W. Banks Dove, secretary of state, with a proposed capital of $2,000 to operate and maintain telephone lines at Cope and adjoining communities. The petitioners are: N. J. Thomas, J. C. Schuler, J. F. Cieckley, and E. E. Ritter, all of Cope.

SOUTH DAKOTA.

The Farmers' Indepeudent Telephone Company has been incorporated at Wessington Spring with a capital stock of $2,500 by J. H. McVey, E. R. Robinson and P. E. Gelhast.

TENNESSEE.

A fire, said to have started in a stairway leading to the headquarters of the Red Cross, totally destroyed the Cumberland Telephone office and exchange building at Sewanee.

TEXAS.

The Union Telephone Company and the McKinney Telephone Company recently agreed to the ordinance by the city commission requiring the two companies to consolidate and to hold the old rates. The Southwestern will take over the Union. They were given three months in which to perfect the actual consolidation.

The Electra Telephone Company was destroyed recently when the business section of that city was swept by fire.

VIRGINIA.

A large and thoroughly up-to-date exchange will be built by the Chesapeake and Potomac Telephone Company on Twenty-eighth street, between Colonial and Debree avenues, Norfolk, and new exchanges at Hampton and Newport News will also be constructed.

An amendment has been made to the charter of the Roanoke and Boutetourt Telephone Company, Fincastle, increasing its capital stock from $10,000 to $15,000. R. D. Kelly, president; J. W. Ikenberry, secretary, both of Daleville.

WASHINGTON.

The Manila Telephone Company of Espanola at the annual meeting elected the following officers: President, W. O. Weyen; secretary, Charles E. Peterson; treasurer, Henry Tank; Lineman, Nicholas Sidel.

WISCONSIN.

At the annual meeting of the Wind Lake Telephone Company of Norway the following officers were elected for the ensuing year: Henry Overson, president; Albert Anderson, secretary; Ole Johnson, treasurer; and Albert Hanson, manager.

At the annual meeting of the stockholders of the Wisconsin Telephone Company in Milwaukee the following directors were elected for the ensuing year: Theodore N. Vail and U. N. Bethell, New York; C. Jay French, Boston; Bernard E. Sunny, Alonzo Burt and H. F. Hill, Chicago; Otto H. Falk, Julius O. Frank, Oliver C. Fuller, Edward A. Uhrig and H. O. Seymour, Milwaukee.